0068851

QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT GROUNDWATER MONITORING DATA FOR THE PERIOD JANUARY THROUGH MARCH 2005.

Fifteen *Resource Conservation and Recovery Act of 1976* (RCRA) sites[1] were sampled during the reporting quarter, as listed in Table 1. Sampled sites include seven monitored under groundwater indicator evaluation ("detection") programs [40 CFR 265.93(b)], seven monitored under groundwater quality assessment programs [40 CFR 265.93(d)], and one monitored under a final-status groundwater corrective action program [WAC 173-303-645(11)].

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Comparison to Concentration Limits

Contamination indicator parameter data (pH, specific conductance, total organic halides, and total organic carbon) from downgradient wells were compared to background values at sites monitored under detection requirements, as described in 40 CFR 265.93. Results of the comparisons are listed in Table 1. Additional explanation, if needed, is provided below.

1301-N Liquid Waste Disposal Facility: Average specific conductance in downgradient well 199-N-3 (1,191 µS/cm) exceeded the critical mean value (1,113 µS/cm) in March. Prior assessment results (Hartman 1992) indicated the elevated specific conductance is related to sulfate and sodium from an upgradient facility. The site will remain in detection monitoring.

1324-N/NA Facilities. Specific conductance at downgradient wells 199-N-72 (768 uS/cm) and 199-N-73 (662 uS/cm) continued to exceed the critical mean value (454 µS/cm) in March. Groundwater quality assessment monitoring in 1992 (Hartman 1992) indicated that the high specific conductance is caused by the non-listed constituents sulfate and sodium. The site will remain in detection monitoring. Downgradient well 199-N-59 could not be sampled in March because the well continued to be dry. The well can be sampled when the water table rises with increased river stage.

1325-N Liquid Waste Disposal Facility. Critical mean values were recalculated this quarter because one downgradient well (199-N-32) could not be sampled because of a pump problem and subsequent access issues. Average specific conductance in downgradient well 199-N-41 (547 µS/cm) continued to exceed the critical mean value (451 µS/cm) in March. DOE notified

[1] A site is a Treatment, Storage, and/or Disposal (TSD) unit or a waste management area associated with a TSD unit.

Ecology of an earlier exceedance and transmitted the results of the groundwater quality assessment (Thompson, 2000). The high specific conductance is believed to originate at an upgradient source, and passed the location of the upgradient well several years ago, so the site will remain in a detection monitoring program.

216-B-3 Pond. Average pH concentration in one downgradient well 699-43-45 (8.7025) exceeded the upper critical limit of this parameter [7.83, 8.48] in January 2005. However, the exceedance was not confirmed by a subsequent sampling event.

Low-Level Waste Management Area 3. Groundwater flow directions have shifted toward the east, with the most recent direction determined to be toward the east-northeast (70 degrees east of north). Wells 299-W10-20 and 299-W10-21 are no longer considered as upgradient wells. Statistical comparisons will resume after new upgradient wells are drilled and a new upgradient baseline is established.

Low-Level Waste Management Area 4. The network has 3 upgradient wells and 1 downgradient well. Downgradient well 299-W15-30 is a replacement well for well 299-W15-16, which went dry. The average total organic halides concentration (356.5 ug/L) in well 299-W15-30 exceeded the critical mean value (99 ug/L). Because well 299-W15-30 is a replacement for well 299-W15-16, which had previous exceedances that originated at an upgradient source (Furman 1999), the site will remain in detection monitoring.

Nonradioactive Dangerous Waste Landfill. Critical mean values were recalculated this quarter because one downgradient well (699-25-34D) was not sampled as scheduled (see Table 2). Average specific conductance from downgradient well 699-25-34B (629.75 uS/cm) exceeded the critical mean of 573 uS/cm in February. Previous exceedances in this well were attributed to non-hazardous constituents from the adjacent Solid Waste Landfill (Morse, 2001). The average total organic halides concentration from the same well (17.8 ug/L) also exceeded the critical mean value (17.4 ug/L) during this reporting quarter. However, the results from quadruplicate measurements were highly variable (ranged from 5.9 to 36.8 ug/L) and were flagged as suspect in HEIS. Verification sampling was conducted in July and results were below the critical mean value.

Wells Not Sampled as Scheduled

The wells listed in Table 2 were not sampled as scheduled. Wells that were delayed from their original sampling date are listed only if the successful sample date was beyond the end of the reporting quarter. The table does not include wells that were reported dry in previous quarterly or annual reports.

Table 1. Status of RCRA Sites, January-March 2005.

Site	Routine sampling?	DG Statistical exceedance?	Comments
Indicator Evaluation Sites [40 CFR 265.93(b)] (sampled semiannually)			
1301-N Liquid Waste Disposal Facility	Yes	Yes[a]	
1325-N Liquid Waste Disposal Facility	Yes	Yes[a]	
1324-N/NA Facilities	Yes	Yes[a]	
216-B-3 Pond	Yes	No	See text
216-A-29 Ditch	No	Not sampled	
216-B-63 Trench	No	Not sampled	
216-S-10 Pond and Ditch	No	Not sampled	Current network 2 shallow and 1 deep DG wells[b]
LERF	No	Not sampled	Current network 1 UG and 1 DG well. No statistical evaluation per Ecology.
LLWMA 1	No	Not sampled	
LLWMA 2	No	Not sampled	Wells monitoring the north part of the LLWMA are dry[b].
LLWMA 3	Yes	Not applicable	No statistical comparisons (see text). 12 of 20 wells in original network are dry[b]
LLWMA 4	Yes	Yes[a]	Only one shallow DG well [b]. See text.
SST WMA A-AX	No	Not sampled	
SST WMA C	No	Not sampled	
NRDWL	Yes	No	See text.
Groundwater Quality Assessment Sites [40 CFR 265.93(d)] (sampled quarterly)			
Seven sites[c]	Yes	Not required	See updates in text.
Final Status Sites [WAC 173-303-645(11)]			
300 Area Process Trenches	Yes	Yes[d]	
183-H Solar Evaporation Basins	No	Not sampled	

CM = Critical mean value(s)
DG = Downgradient
LERF = Liquid Effluent Retention Facility
LLWMA = Low-Level WMA
NRDWL = Nonradioactive Dangerous Waste Landfill
SST = Single-Shell Tanks
UG = upgradient
WMA = Waste Management Area

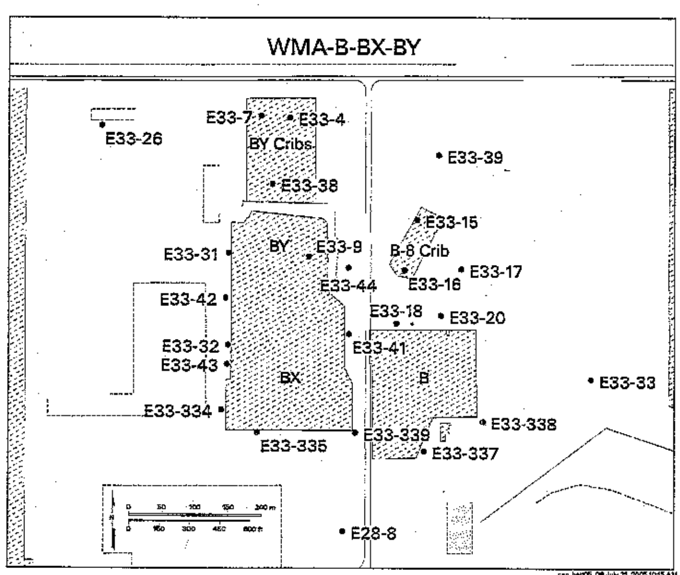
[a] No indication of dangerous waste contamination from facility; see text for explanation.
[b] Well installation needs are addressed each year as part of the M-24 milestone process.
[c] U-12 Crib, PUREX Cribs, SST WMAs B-BX-BY, S-SX, T, TX-TY, and U.
[d] Site has entered corrective action monitoring because of previous exceedances.

Table 2. Wells Not Sampled as Scheduled During the Reporting Period.

Well	RCRA Site	Date Scheduled	Date Sampled	Comment
199-N-2	1301-N	3/19/2005	4/26/205	Safety issue with pump mount.
199-N-32	1325-N	3/15/2005	--	Pump failure. No access because of surface remediation.
299-E33-9	WMA B-BX-BY	2/2005	--	Restricted access; safety concerns.
299-E33-13	WMA B-BX-BY	1/31/2005	4/25/2005	Pump malfunction.
299-W22-47	WMA S-SX	3/2005	4/14/2005	No discharge fitting.
399-1-10A	300 APT	3/18/2005	4/14/2005	Blowing dust; no access.
399-1-10B	300 APT	3/18/2005	4/14/2005	Blowing dust; no access.
299-W14-15	WMA TX-TY	2/8/2005	5/10/2005	Pump problem repaired in April. February sampling event cancelled; sampled in May for next quarter.
299-W22-49	WMA S-SX	3/2/2005	6/16/2005	Water level below pump intake. Pump lowered; sampled in June for next quarter.
699-25-34D	NRDWL	2/2005	6/21/2005	No access; new training requirements

Status of Assessment Programs

This section describes the seven RCRA sites currently monitored under groundwater quality assessment.



Single-Shell Tanks Waste Management Area B-BX-BY: Based on in situ measurements, the groundwater is nearly stagnant in the north part of the waste management area, flowing slowly to the southwest. Prior to Hanford operations, this region was dry, with the natural boundary between the aquifer and the basalt subcrop extending along a southeast/northwest line approximately through the 241-BX and 241-B Tank Farms. At the southern boundary of the tank farms, groundwater appears to flow toward the south-southeast and southeast, based on in situ measurements. This southward flow direction is supported by comparing local hydrographs (Hartman et al., 2005) and time series mapping of nitrate data; however, there remains high uncertainty regarding the groundwater flow conditions beneath this WMA. There has been no significant difference in flow direction or rate since the last quarterly report. Well 299-E33-9, located in the 241-BY Tank Farm has not been sampled since March 2004 due to tank farm safety issues, restricting access to the well.

Additional data were received for wells in the BY cribs that had not been sampled for 10 to 12 years. With the exception of sulfate, contaminant concentrations in these wells were the highest values in the northwest section of the 200 East Area. Of note are changes in the concentrations of a variety of contaminants in well 299-E33-4, located near the 241-B-46 Crib (Table 3). There were significant reductions in contaminant levels for technetium-99, nitrate, cobalt-60 and sulfate, while cyanide and tritium increased. Tritium concentration increased over two-fold to one of the highest values observed in the recent past. The uranium concentration in well 299-E33-4 remained at a background level of 3.64 μg/L this quarter, indicating this region is outside the uranium plume found to the south.

Table 3. Selected Contaminant Concentrations in Well 299-E33-4.

Constituent	Units	Concentration Feb. 2005	Concentration Nov. 2004	Drinking Water Standard
Technetium-99	pCi/L	17,500	23,100	900
Nitrate	mg/L	1,340	1,590	45
Tritium	pCi/L	118,000	45,300	20,000
Cyanide	ug/L	859	757	200
Cobalt-60	pCi/L	105	200	100
Sulfate	mg/L	189	520	250 (secondary)

In general, over most of the waste management area nitrate levels continued to increase over time (Figure 1), with a higher value at well 299-E33-44 (327 mg/L) and decreasing to the south at well 299-E33-41 (55.8 mg/L). Nitrate levels are above the drinking water standard of 45 mg/L in these wells. A similar pattern is seen in technetium-99 levels, with values ranging from 8,320 pCi/L at well 299-E33-44 to 410 pCi/L in the south at well 299-E33-41. Of note are the sharply increasing technetium-99 levels in well 299-E33-18 as shown in Figure 2. The technetium-99 concentration increased from 1,620 pCi/L in August 2004 to 2,560 pCi/L in February 2005.

The uranium concentration in well 299-E33-18 has more than doubled from 207 μg/L in November 2003 to 454 μg/L in February 2005 (Figure 3). In the past, the uranium plume was centered on well 299-E33-9, located in the 241-BY Tank Farm. The February uranium level in nearby well 299-E33-44 was 264 pCi/L, indicating a reduction in uranium near the 241-BY Tank Farm. Conversely, uranium north of the 241-BY Tank Farm in well 299-E33-38 decreased from 330 in November 2004 to 303 in February 2005.

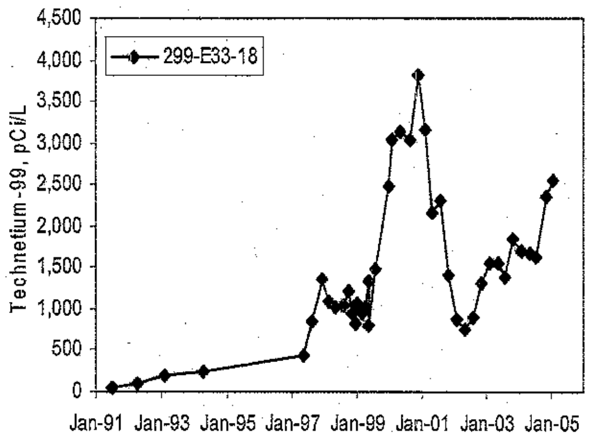


Figure 2. Technetium-99 in Well 299-E33-18.

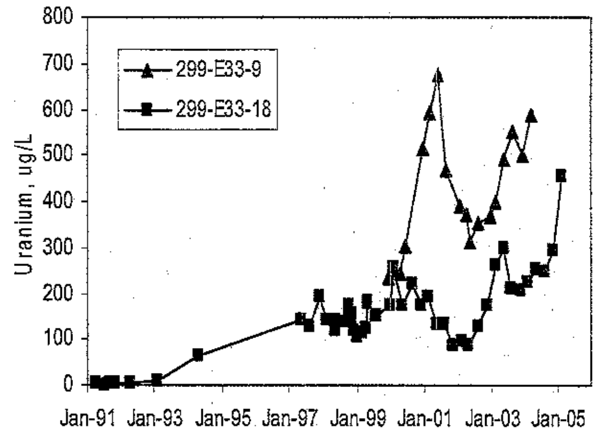


Figure 3. Uranium in Wells 299-E33-9 and 299-E33-18.

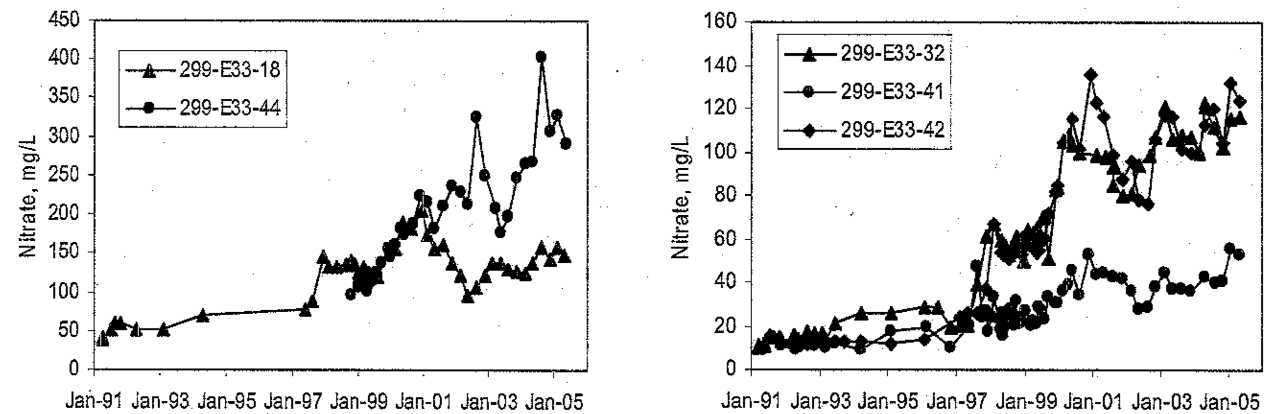
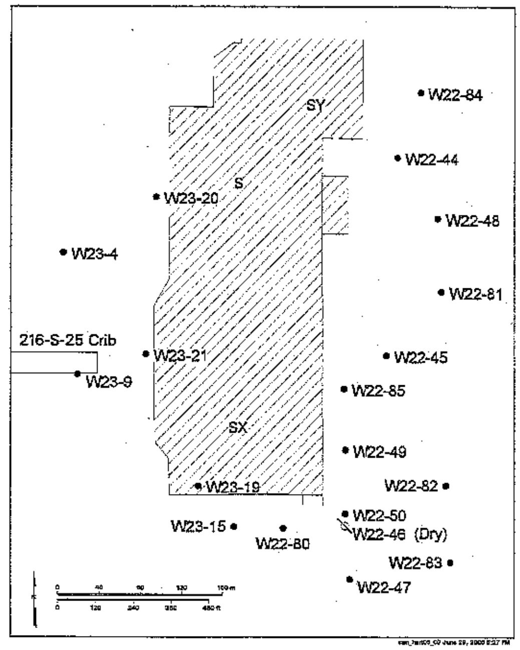


Figure 1. Nitrate in Wells Monitoring WMA B-BX-BY.

Single-Shell Tank Waste Management Area S-SX: Groundwater beneath this site is contaminated with hexavalent chromium, nitrate, and technetium-99 attributed to two general source areas within the WMA. In addition, tritium and carbon tetrachloride are present in groundwater beneath the WMA, but their sources are from adjacent facilities. All analytical results from groundwater samples collected during the quarter were on trend.

Water level measurements in waste management area wells during the quarter indicate that the water table has continued to decline at a steady rate of approximately 0.3 meter per year; this rate of decline has remained the same since about 2000. The gradient and flow direction are stable, with flow to the east over the general area of the WMA, based on water level and contaminant migration data. All water levels measured during the quarter were consistent with the falling water table trend. Well 299-W22-49 was not sampled during the quarter because the pump intake was above the water level. The pump was subsequently lowered and the well was sampled as scheduled in June.

The northern contaminant plume has an apparent source in S Tank Farm and passes through wells 299-W22-44 and 299-W22-48. The width of this plume has stabilized, as indicated by trends of chromium, nitrate, and technetium-99 in well 299-W22-44, which have peaked and are now trending downward. This suggests that the plume is continuing to migrate downgradient. At the same time, the downward trends in nitrate and technetium-99 concentrations in well 299-W22-48 appear to have leveled off, although chromium continued to drop. In both wells, the plume-defining constituents remained at about the same levels, with chromium well below the drinking water standard (100 ug/L) at ~20 ug/L, nitrate at the drinking water standard (45 mg/L), and technetium-99 slightly above the drinking water standard (900 pCi/L).



The contaminant plume migrating from the SX Tank Farm in the south portion of the WMA continued to spread downgradient at ~0.17 meter per day (~17 feet per month). This plume contains elevated concentrations of chromium, nitrate, and technetium-99. Chromium concentrations in the source area (represented by well 299-W23-19) increased again during the quarter by about 45% (Figure 4). The chromium concentration rose to 686 μg/L in March 2005, an increase of 213 ug/L from the previous quarter, and is nearly seven times the drinking water standard. As reported previously, chromium concentrations increased in the source area while technetium-99 (see Figure 4) and nitrate decreased or remained stable during 2004. Since the previous quarter, technetium-99 and nitrate concentrations in well 299-W23-19 increased slightly.

Concentrations of plume constituents in downgradient regions have peaked in well 299-W22-50 and continued to increase in well 299-W22-83 (Figure 5). In the mid-plume area (as represented by well 299-W22-50), both technetium-99 and chromium reached peak concentrations near the end of 2003 and had been dropping since that time until this quarter, when their concentrations increased. On the distal margin of the plume (as indicated by well 299-W22-83), technetium-99 and chromium concentrations continued to increase. Based on the time separation of the technetium and chromium trends between the two wells, it appears that there is about a two year lag between the arrival of the plume at well 299-W22-50 and then at well 299-W22-83, located farther downgradient. Using these results and the approximately 230 meter distance between wells, the groundwater flow velocity is about 115 meters per year or 0.3 meter per day. Figure 5 shows how technetium-99 and chromium have increased during the quarter in well 299-W22-83. Based on these results, technetium-99 and chromium concentrations should peak in 2005 or 2006 in well 299-W22-83.

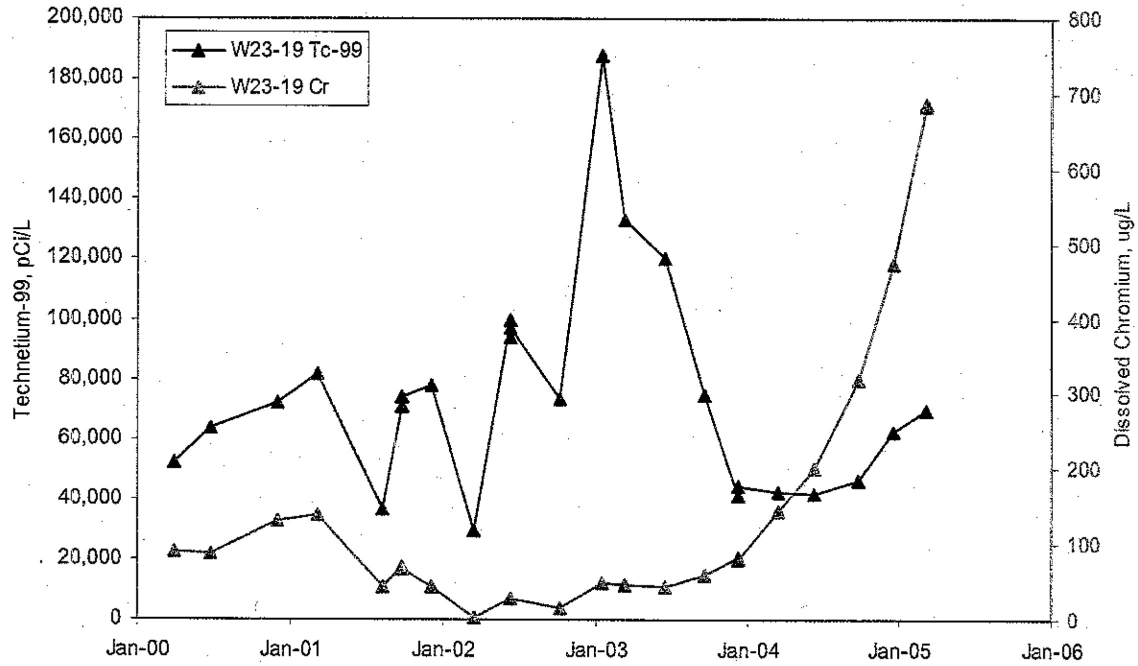


Figure 4. Tc-99 and Chromium Concentrations in Well 299-W23-19.

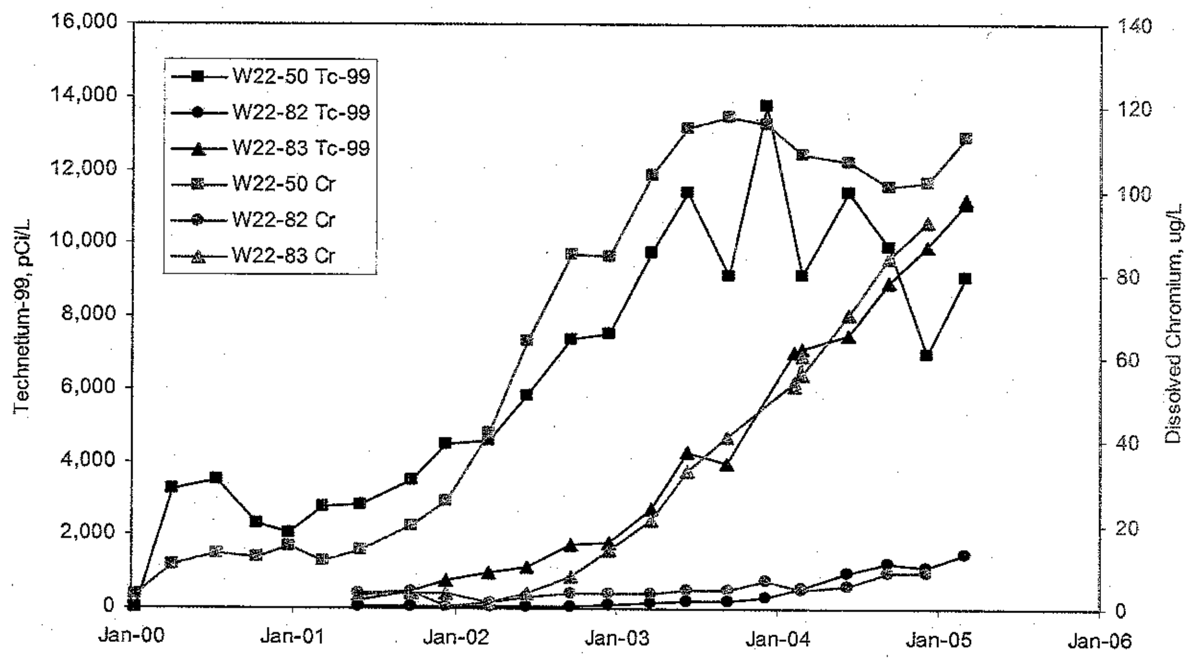


Figure 5. Technetium-99 and Chromium in Downgradient Wells at WMA S-SX.

Water samples from new well 299-W22-47, drilled southeast of SX Tank Farm, were collected every 1.5 meters (5 ft) using air-lift techniques and pumped samples were collected every 6.1 meters (20 ft). The results, shown in Figure 6, indicate that the SX plume is present at this location with elevated concentrations of chromium, nitrate, and technetium-99 greater than their respective drinking water standards. Carbon tetrachloride, from the regional plume, also exceeded its drinking water standard. Only water samples that were collected using a pump were included in the figure. Air-lifted samples were deemed non-representative because the water samples were in contact with sediment in a collection bottle for up to several days before a filtered sample was collected. During this time, the chromium in solution is believed to have been reduced by freshly exposed sediment surfaces (ground up basalt particles) and precipitated from solution, resulting in artificially low chromium concentrations in solution. Chromium concentrations in all of the air-lifted samples were much lower than adjacent samples collected using a pump.

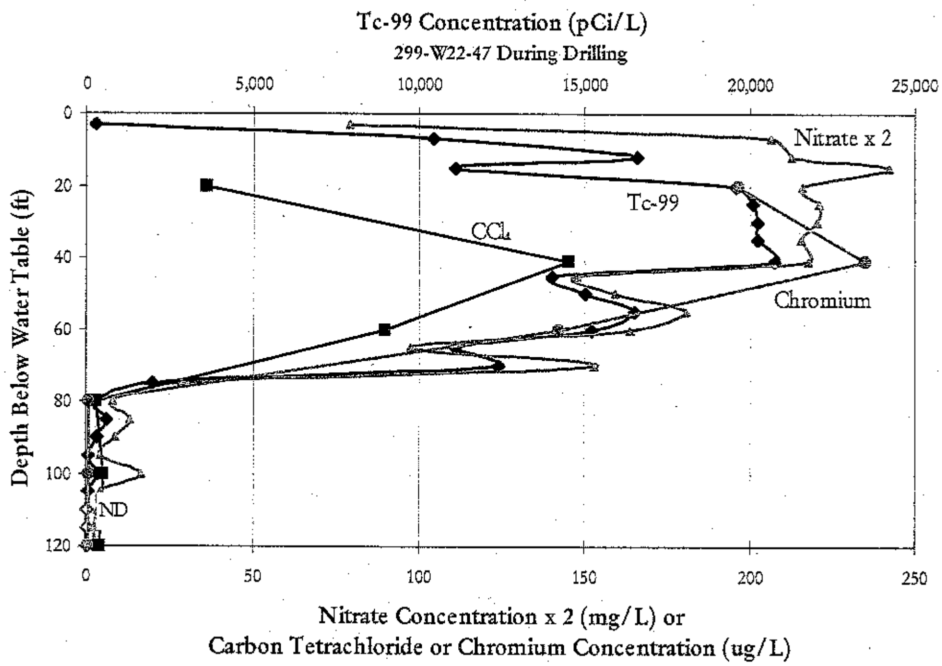


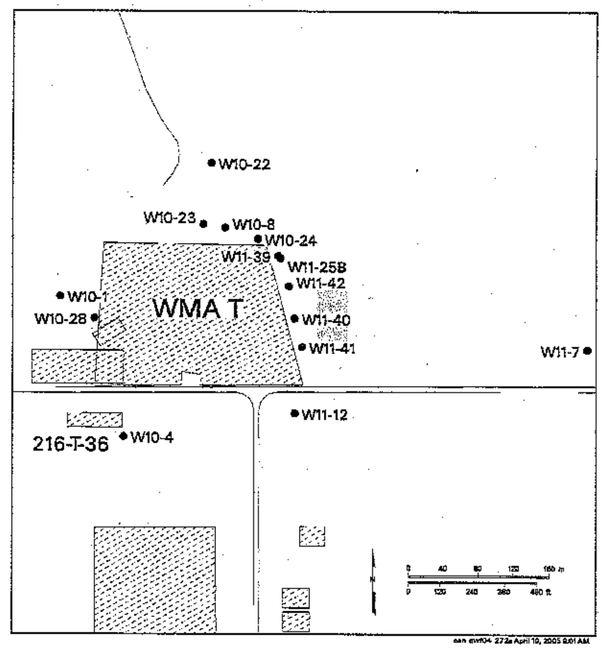
Figure 6. Contaminant Concentrations With Depth in Well 299-W22-47 During Drilling.

Based on these preliminary characterization data, the plume is present in the upper 23 meters (75 feet) of the aquifer at this location and it appears that the longitudinal axis of the plume is farther south than previously thought. The first routine sample were collected from this well in the next quarter.

Single-Shell Tank Waste Management Area T: Water levels in wells near WMA T continued to decline during the reporting period. The measured amount of decline during the quarter was between 0.1 and 0.2 meter. Groundwater flow direction at WMA T is toward the east-northeast to east-southeast at a rate of about 0.01 to 0.03 meter per day.

All wells in the monitoring network were successfully sampled during the reporting quarter.

Chromium, carbon tetrachloride, and trichloroethene continued to be the dangerous waste constituents found in the groundwater beneath WMA T. The source of the carbon tetrachloride and trichloroethene was liquid disposal associated with processes at the Plutonium Finishing Plant and not WMA T. Carbon tetrachloride and trichloroethene are monitored as part of the 200-ZP-1 Operable Unit. Nitrate and fluoride are also found in groundwater beneath the facility. In addition to the dangerous waste constituents, technetium-99 and tritium, non-RCRA-regulated constituents, are found in groundwater at the WMA.



Chromium concentrations exceeded the drinking water standard (100 µg/L) in five wells at WMA T in February 2005. The highest chromium concentrations were in wells 299-W10-4, located south of the southwest corner of the WMA, and in 299-W10-28 located upgradient of the WMA (Figure 7). The concentration of chromium in well 299-W10-4 was 675 µg/L, down from722 µg/L the previous quarter. Chromium concentrations have been increasing in this well since 1997 and the concentration has almost doubled since the beginning of 2004. The concentration of chromium in well 299-W10-28 in February was 261 µg/L. The concentration of chromium in this well has generally been increasing since the well was drilled at the end of 2001 but may have peaked in May 2004 (see Figure 7).

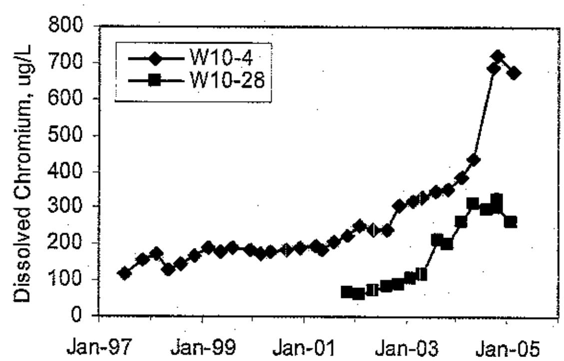


Figure 7. Chromium concentration in wells 299-W10-4 and 299-W10-28 at WMA T.

Downgradient of WMA T, chromium concentrations exceeded the drinking water standard in three wells (Figure 8). The highest concentration was 172 µg/L in well 299-W11-42. Chromium concentrations in this well and in well 299-W11-41 have steadily increased since about mid 2002.

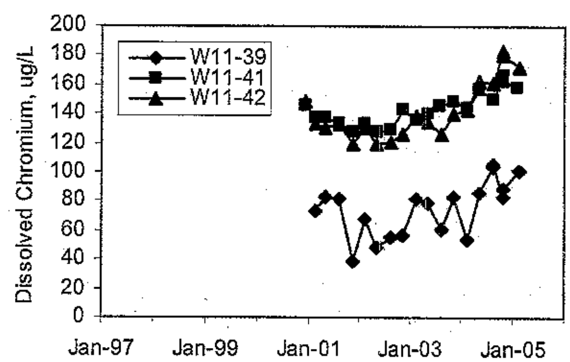


Figure 8. Chromium concentration in selected downgradient wells at WMA T.

Nitrate concentrations remained above the 45 mg/L drinking water standard in all wells in the WMA T network during the reporting period. The highest concentrations were in well

299-W10-4, where nitrate decreased from 7,610 mg/L in November 2004 to 2,420 mg/L during the reporting period (Figure 9). The November result was out of trend and may be erroneous. The concentrations of most major cations and anions in this well have undergone large increases during the past year. The reason for the dramatic changes is not known and the composition of the groundwater in well 299-W10-4 will be closely watched during the upcoming quarter.

Nitrate concentrations in downgradient monitoring wells at WMA T either remained fairly constant with previous quarters or increased slightly (Figure 9). Concentrations in downgradient wells were between 113 mg/L (well 299-W11-39) and 1,120 mg/L (well 299-W11-42).

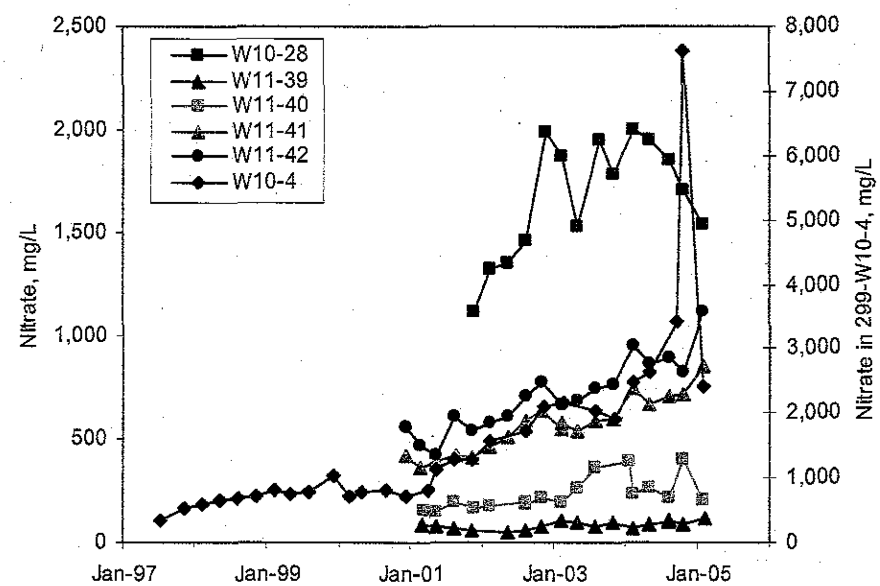


Figure 9. Nitrate Concentrations in Selected Wells AT WMA T. Note separate y scale for well 299-W10-4.

Fluoride concentration exceeded the drinking water standard of 4 mg/L in three wells at WMA T during the reporting period. These were 299-W10-23, in which the fluoride concentration was essentially unchanged from the previous quarter at 4.4 mg/L; well 299-W10-8, in which the concentration increased dramatically from 4.5 mg/L in November 2004 to 10.5 mg/L in February 2005; and well 299-W10-4, in which the fluoride concentration increased from 4.5 mg/L in November 2004 to 10.1 mg/L in February 2005. The increases in both well 299-W10-8, located north of the WMA, and in well 299-W10-4, located south of the WMA, are extremely large. The increase in fluoride concentration in well 299-W10-4 is accompanied by recent large increases in most major cations and anions. The fluoride concentration in both wells will be closely watched during the second quarter of 2005 to see whether the current concentrations are representative of the fluoride content of the aquifer. The concentration of fluoride exceeded the secondary drinking water standard of 2 mg/L in three additional wells at the WMA during the first quarter of 2005 (299-W10-24, 2.4 mg/L; 299-W11-41, 2.3 mg/L); and 299-W11-42, 2.8 mg/L).

The Atomic Energy Act regulated constituent technetium-99 exceeded the 900 pCi/L drinking water standard in five wells at WMA T during February 2005 (Figure 10). The greatest concentration was 12,200 pCi/L in well 299-W11-39, which was down from 16,700 pCi/L in November 2004. This was the second quarter in a row that substantial decreases in technetium-99 concentration have occurred in the well. Other wells exceeding the technetium-99 standard were 299-W10-24 (1,470 pCi/L), 299-W11-40 (1,440 pCi/L), 299-W11-41 (3,270 pCi/L), and 299-W11-42 (1,910 pCi/L). The technetium-99 concentrations in the latter wells remained fairly constant or decreased slightly from the previous quarter's concentration.

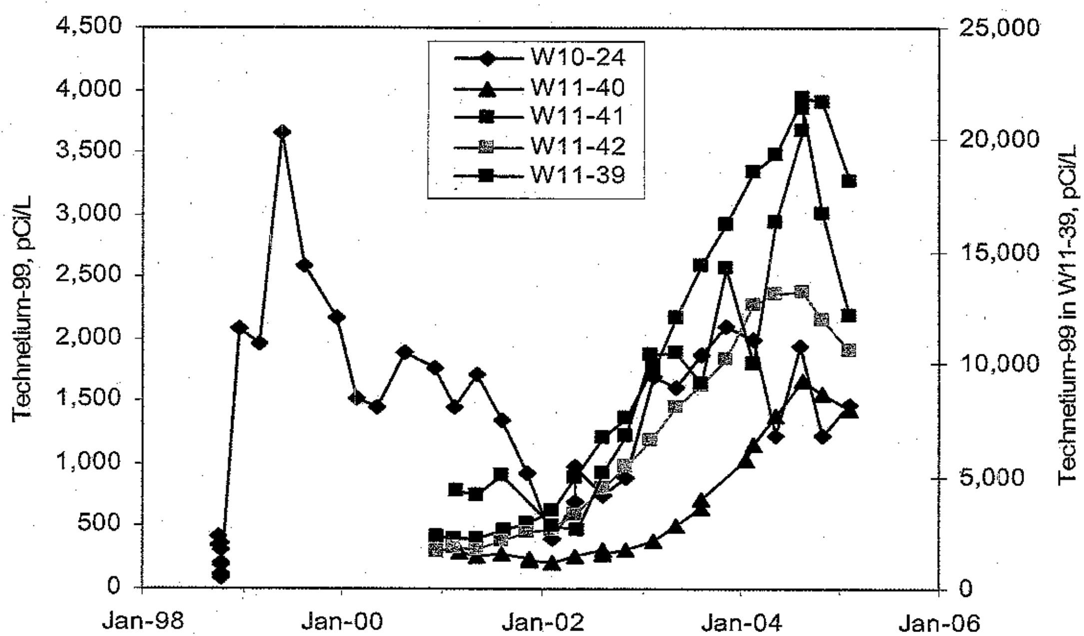


Figure 10. Technetium-99 Concentrations in Selected Wells Monitoring WMA T. Note separate y scale for well 299-W11-39.

Tritium exceeded the drinking water standard of 20,000 pCi/L in one well at WMA T during the reporting period. The tritium concentration in well 299-W11-12 was 47,400 pCi/L in February 2005, essentially unchanged from 42,000 pCi/L during the previous quarter. The tritium concentration generally has been decreasing slightly since the well was first regularly sampled for tritium in late 1998.

Finally, the pH of the February 2005 sample from well 299-W10-24 exceeded the drinking water standard of 8.5 with a value of 8.58. The pH of samples from this well generally exceed the drinking water standard by a small amount and the reason for the exceedance is not known.

Well 299-W11-25B was drilled in February and March 2005 adjacent to existing well 299-W11-39. It was sampled every 5 feet during drilling; and the samples were analyzed for technetium-99 and nitrate. Descriptions of the sampling and analysis activities and a discussion of the results of the analyses were given in the last quarterly report (October-December 2004). Figure 11 summarizes the analytical results. The data in Figure 11 show very high concentrations of technetium-99 and nitrate throughout the upper part of the aquifer at the location of well 299-W11-25B.

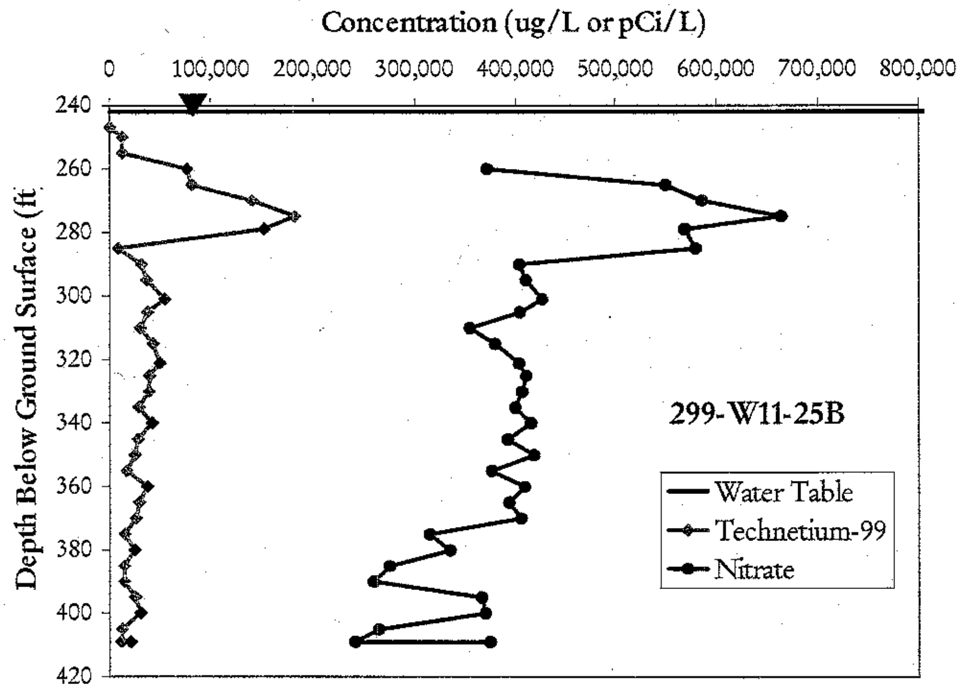
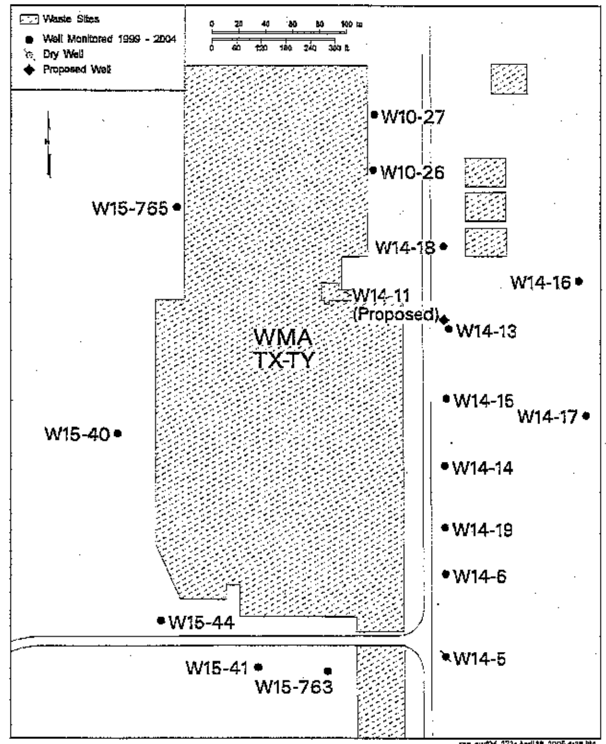


Figure 11. Technetium-99 and nitrate concentration versus depth below the ground surface in well 299-W11-25B. Red symbols represent pumped samples; all other points are air lifted samples.

Construction of well 299-W11-25B began March 15, 2005. On March 30, 2005, it was discovered that the 4-inch casing was damaged and electrical tapes or pumps could not be lowered past 165 feet in the well. The current plan is to extract the existing stainless steel casing and redrill the well at the same location.

Single-Shell Tank Waste Management Area TX-TY: Water level measurements in wells near WMA TX-TY showed between about 0.1 and 0.2 meter decline in the water table during the reporting period. The groundwater flow direction at WMA TX-TY varies from the north to the south part of the WMA. In the north, groundwater flow is east to southeast at a rate of about 0.01 to 0.025 meter per day. In the south, where groundwater flow has been greatly altered by the 200-ZP-1 pump and treat system, flow direction is to the south or south-southwest at about 0.3 meter per day.

All wells were successfully sampled during the first quarter of 2005 except well 299-W14-15, which had an inoperable pump. The pump was repaired in April 2005 and the well was sampled in May 2005 as part of the next quarterly sampling event.



Chromium, carbon tetrachloride, and trichloroethene continued to be the dangerous waste constituents found in the groundwater beneath WMA TX-TY. The source of the carbon tetrachloride and trichloroethene was liquid disposal associated with processes at the Plutonium Finishing Plant and not WMA TX-TY. Carbon tetrachloride and trichloroethene are monitored as part of the 200-ZP-1 Operable Unit. Nitrate concentrations also are elevated in the groundwater beneath WMA TX-TY. In addition to the dangerous waste constituents, technetium-99, iodine-129, and tritium, all non-RCRA-regulated constituents, are found in groundwater at the WMA.

Chromium exceeded the 100 µg/L drinking water standard in well 299-W14-13 at WMA TX-TY. The chromium concentration in that well was 768 µg/L during the reporting quarter, up from 653 µg/L during the previous quarter. The chromium concentration generally has been increasing in the well since May 2001. The chromium plume at WMA TX-TY is defined only by well 299-W14-13. The chromium concentrations in the nearest wells to the north, south and east (downgradient of well 299-W14-13) have never exceeded the drinking water standard. The most likely source for the chromium at WMA TX-TY is the WMA itself or the nearby TY cribs.

Nitrate continued to exceed the drinking water standard (45 mg/L) in all wells in the WMA TX-TY monitoring network during the reporting quarter. The highest nitrate concentration was found in well 299-W14-13 in the central part of the east side of the WMA. The nitrate concentration in this well was 474 mg/L in February 2005, up slightly from 423 mg/L the previous quarter. The regional nitrate plume at WMA TX-TY is attributed to past disposal practices throughout the 200 West Area. The relatively local high nitrate concentration at well 299-W14-13 may be due to one or a combination of nearby liquid disposal facilities and WMA TX-TY.

Manganese exceeded the secondary drinking water standard (50 µg/L) in well 299-W10-27 where the concentration was 110 µg/L in February 2005. This was up from the 97 µg/L concentration in November 2004. This well has a history of high manganese concentration. The manganese concentration has been decreasing since the well was drilled in August 2001 at which time the manganese concentration was 862 µg/L. The reason for the high manganese is not known. The well also has relatively high nitrite (2.0 mg/L) and low dissolved oxygen (1.5 mg/L).

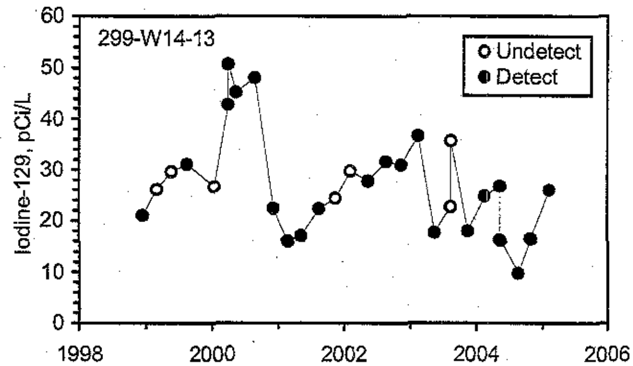


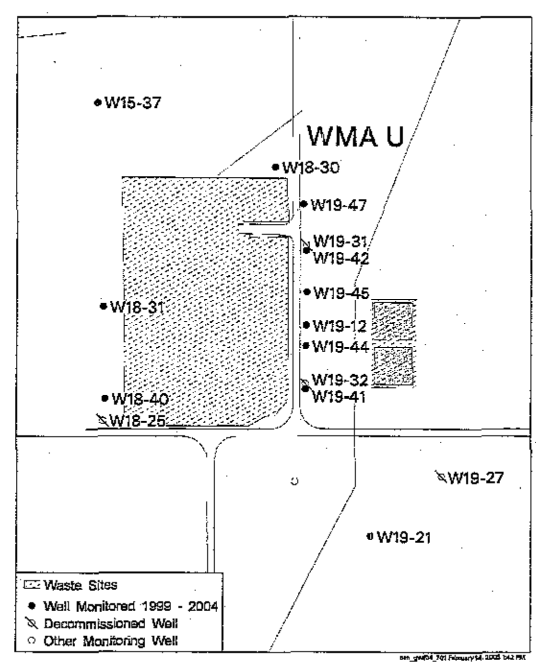
Figure 12. Iodine-129 concentration in well 299-W14-13 at WMA TX-TY.

The Atomic Energy Act constituent iodine-129 exceeded the 1 pCi/L drinking water standard in one well at WMA TX-TY in February 2005. The concentration of iodine-129 in well 299-W14-13 was 26.1 pCi/L, up from 16.5 pCi/L during the previous quarter (Figure 12). The iodine-129 concentration has fluctuated between 9.7 and 50 pCi/L since the well was drilled in late 1998.

The concentration of Atomic Energy Act constituent technetium-99 was 6,970 pCi/L in well 299-W14-13 during February 2005. This was down from 8,400 pCi/L in November 2004. Technetium-99 concentrations have been greater than the 900 pCi/L drinking water standard since the well was drilled in 1998 and generally increased with time until August 2004 when the concentration began to decrease. The technetium-99 plume is small and defined only by well 299-W14-13, although technetium-99 had been increasing in well 299-W14-18, north of 299-W14-13, until this reporting period.

Tritium exceeded the 20,000 pCi/L drinking water standard in one downgradient well at WMA TX-TY. The tritium concentration was 1,700,000 pCi/L in well 299-W14-13 in February 2005, essentially unchanged from the previous quarter.

Aluminum concentrations exceeded the secondary drinking water standard of 50 μg/L in several wells at WMA TX-TY during February 2005. Anomalously high aluminum values have been found in many wells across the Hanford Site recently. The groundwater project's QC team is working with the analytical laboratory to resolve the aluminum issue.



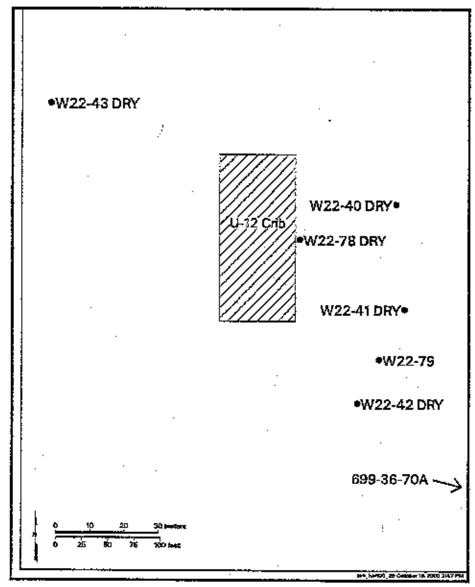
Single-Shell Tank Waste Management Area U: This WMA, which has been in assessment monitoring since 1999, has affected groundwater quality with elevated concentrations of chromium, nitrate, and technetium-99. In the past several years, chromium concentrations have decreased to near the detection limit. In the past, contamination was limited to the south half of the downgradient (east) side of the WMA, but in the last half of 2004, technetium-99 concentrations began to rise rapidly in several of the downgradient wells in the north half of the WMA. Carbon tetrachloride is also present beneath the WMA at concentrations above the drinking water standard in all monitoring wells in the network. The carbon tetrachloride is associated with the regional plume with sources upgradient of the WMA.

The water table continued to decline during the reporting quarter at a rate of ~0.3 meter per year. All of the wells responded similarly so the gradient and flow direction as determined from water levels are stable, with the interpreted flow direction to the east at a rate of 0.008 to 0.2 meter per day.

Technetium-99 concentrations in wells located on the northeast side of the WMA, began rising in the second half of 2004. The technetium-99 concentration in well 299-W19-45 increased from 989 to 1120 pCi/L between October 2004 and February 2005. In well 299-W19-42, technetium-99 decreased from 484 to 411 pCi/L during the same period. In new well 299-W19-47 the technetium-99 concentration increased from 591 to 855 pCi/L, just less than the drinking water standard of 900 pCi/L.

Nitrate concentrations have also remained on trend. Downgradient wells on the north half of the WMA have continued to increase slowly, at a rate similar to that in upgradient wells, and are below the drinking water standard. Nitrate concentrations in downgradient wells on the south half of the WMA also increased, but at levels above the drinking water standard.

216-U-12 Crib: The current monitoring network for the 216-U-12 Crib consists of only two downgradient wells (299-W22-79 and 699-36-70A). There is currently no upgradient well available at this network. Both wells were sampled in March 2005. The site is in assessment for elevated specific conductance and nitrate and is sampled quarterly.

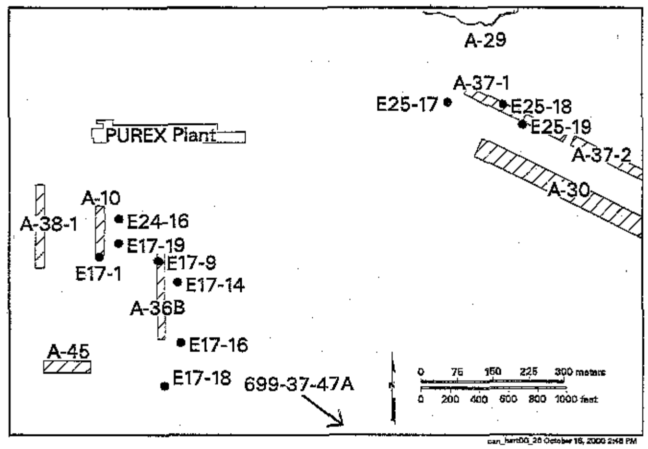


DOE has requested that the 216-U-12 crib be administratively closed, on a review of waste disposal records for the facility. Ecology is considering DOE's request.

For downgradient well 299-W22-79, specific conductance and nitrate decreased since the previous quarter and continued on a declining trend. Specific conductance was measured at 283 µS/cm and nitrate was measured at ~31.4 mg/L for March, remaining below the 45 mg/L drinking water standard. All other results were declining, on trend, and/or below the standard.

For well 699-36-70A, specific conductance and nitrate decreased slightly from the previous results. Specific conductance decreased slightly to ~477 µS/cm in March. Nitrate decreased to ~67.9 mg/L in March, remaining above the 45 mg/drinking water standard. All other results were declining, on trend, and/or below the standard.

Based on the regional CERCLA 200–UP-1 OU network, the groundwater flow direction beneath the crib has remained relatively unchanged, toward the east-southeast for years. Water levels continue to decline around the U-12 Crib and vicinity at about 0.3 m (1 ft) per year as the regional water table drops.



PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1): Three of the 11 near-field network wells were sampled during the reporting quarter. This reduced set of wells is sampled quarterly as required by 40 CFR 265.93 [d][7][i] to determine if there are any changing contaminant conditions near the three PUREX cribs. The remainder of the wells (7) are sampled semiannually (usually April and October) in order to more adequately cover the area immediately downgradient of the PUREX cribs, as well as to sample the two upgradient wells. Water levels were measured at each well at the time of sampling.

Beneath the PUREX Cribs, the differences in water table elevations from well to well are very small. Typically, the elevation difference between the lowest and highest levels is about 0.2 m. During the reporting period the greatest water level difference was 0.12 m (about 4.7 inches) over the distance from the 216-A-10 crib to the 216-A-37-1 crib (a distance of about 900 m). Therefore, the water table gradient is too low to determine groundwater flow rate or flow direction reliably. However, groundwater flow directions determined from the movement of groundwater contamination plumes indicate that the regional flow is toward the southeast.

Nitrate was reported at levels greater than the drinking water standard (45 mg/L) at both wells monitoring the 216-A-36B and 216-A-10 cribs. The highest reported level during the reporting period was 106 mg/L at well 299-E17-14 located near the 216-A-36B crib. At this well the trend is generally upward (since 2001) except for the latest two reported values (108 and 106 mg/L) (Figure 13).

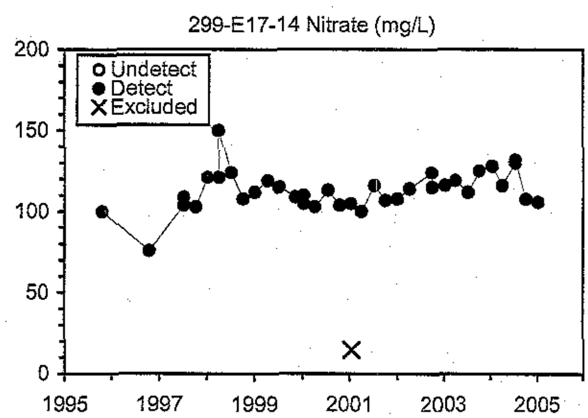


Figure 13. Nitrate in Well 299-E17-14.

Aluminum concentrations in the three wells sampled during the reporting period varied from 61.8 ug/L at well 299-E17-14 (near the 216-A-36B crib) to 72.5 ug/L at well 299-E24-16 (near the 216-A- 10 crib). The secondary drinking water standard is 50 ug/L. Aluminum concentrations have varied greatly in PUREX cribs wells, as well as other Hanford Site wells, and the results here are considered unreliable.

Iodine-129 exceeded the drinking water standard (1.0 pCi/L) near the 216-A-36B and 216-A-10 cribs. The highest reported level was 9.2 pCi/L at well 299-E17-14, which is located near the 216-A-36B crib. The trend for iodine-129 at this well is declining slightly since 2003.

Gross beta and strontium-90 (a beta-emitter) remained elevated at well 299-E17-14. Both exceeded their respective drinking water standards (50 and 8 pCi/L). The concentration of gross beta during the reporting quarter was 58.2 pCi/L while strontium-90 was 19 pCi/L. Although both showed slightly upward trends prior to 2000, more recent results indicate that the trends have stabilized. The reported level for gross beta is higher than would be accounted for by the strontium-90 alone. [The ratio of gross beta to strontium-90 would be expected to be about 2 if strontium-90 were the only beta-emitter present.] The remainder of the gross beta is most likely technetium-99 (drinking water standard 900 pCi/L), another beta emitter.

Tritium exceeded its drinking water standard (20,000 pCi/L) at all three of the wells sampled during the reporting quarter. Groundwater samples from the two wells located near the 216-A-36b and 216-A-10 cribs exceeded the drinking water standard by more than a factor of 10. The highest concentration was 522,000 pCi/L at well 299-E17-14 near the 216-A-36B crib. The trend in this well has been decreasing since 1997. However, at well 299-E24-16 (near the 216-A-10 crib) the latest results were 329,000 and 328,000 (replicate samples), and the trend has been slightly increasing since 2002. The increasing trend at well 299-E24-16 is most likely related to a slight shifting in groundwater flow directions due to the elimination of waste water discharges at the 216-B-3 Pond (B Pond).

Quality Control

Highlights of the groundwater project's quality control (QC) program for January-March 2005 are summarized below. We are transmitting a separate attachment with more specific QC information. The QC program indicated that most of the data were acceptable for use in the evaluations and statistical comparisons discussed above. Data related to QC issues have been flagged in the database or are undergoing further review.

- Ninety results were flagged with an H due to missed holding times. Nitrate and volatile organic compounds account for most of the flagged results.
- The problem with elevated aluminum results at many sites continued this quarter. Split samples analyzed for aluminum by STL St. Louis and Lionville Laboratory had some higher results determined by STL. However, the data were inconclusive due to the low sample concentrations. STL St. Louis analyzed a special set of blind standards containing aluminum, and the results were biased high. These results, combined with some elevated blank results, suggest that the problem may be caused by a high instrument background at STL St. Louis.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for eleven pairs of results failed to meet the acceptance criteria. Cyanide, fluoride, nitrogen in nitrite, iron, manganese, zinc, and acetone were the constituents with out-of-limit results.

- Approximately 2% of the field blank results exceeded the QC limits. Methylene chloride had the greatest number of out-of-limit results. Overall, the field blank results should have little impact on the interpretation of 1st quarter groundwater data.
- Laboratory performance on the analysis of blind standards was good overall. Severn Trent St. Louis had out-of-limit results for total organic carbon, total organic halides, aluminum, and carbon tetrachloride. Lionville Laboratory had unacceptable results for total organic carbon. One of STL Richland's results for plutonium was outside the acceptance limits. All of Eberline Services' results for gross beta were acceptable.
- Performance-evaluation study results were available from three Water Pollution studies, one investigative report for a Water Pollution study, a Mixed Analyte Performance Evaluation Program study and one Multi-Media Radiochemistry Proficiency Testing Program study this quarter. The majority of the labs' results were within the acceptance limits, indicating good performance overall.
- Approximately 97% of the laboratory QC results for this quarter were within the acceptance limits, suggesting that the analyses were in control and reliable data were generated.

References

Hartman, M.J., 1992. *Results of Ground Water Quality Assessment Monitoring at the 1301-N Liquid Waste Disposal Facility and 1324-N/NA Facilities*, WHC-SD-EN-EV-003, rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hartman, M.J., L.F. Morasch, and W.D. Webber, editors. 2005. *Hanford Site Groundwater Monitoring for Fiscal Year 2004*. PNNL-15070. Pacific Northwest National Laboratory, Richland, Washington.

Morse, John G., RL, to Jane Hedges, Ecology, "Results of Assessment at the Non-Radioactive Dangerous Waste Landfill (NRDWL)," June 7, 2001. 01-GWVZ-025.

Thompson, K. Michael, RL, to Jane Hedges, Ecology, "Results of Assessment at the 1325-N Facility," July 22, 2000.

Hanford Groundwater Performance Assessment Project
Quality Control Report
January 1 to March 31, 2005

Highlights

- Ninety results were flagged with an H due to missed holding times. Nitrate and volatile organic compounds account for most of the flagged results.
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- Approximately 97% of the laboratory QC results for this quarter were within the acceptance limits, suggesting that the analyses were in control and reliable data were generated.

This quality control (QC) report presents information on laboratory performance and field QC sample results for the 1st quarter of CY 2005. Routine chemical and radiochemical analyses were performed by Severn Trent Laboratories, Inc. (St. Louis, MO and Richland, WA) for Hanford Groundwater Performance Assessment Project (HGWPAP) samples. Supplemental analyses of split samples and blind standards were performed by Lionville Laboratory (Lionville, PA) and Eberline Services (Richmond, CA). Severn Trent, Lionville Laboratory, and Eberline Services operate under contract with Fluor Hanford, Inc. Groundwater sampling was conducted by Fluor Hanford, Inc. nuclear chemical operators (NCOs) under the direction of Duratek Federal Services Incorporated. The tasks conducted by the samplers and Duratek included bottle preparation, sample set coordination, field measurements, sample collection, sample transport and shipping, well pumping, and coordination of purgewater containment and disposal.

Tables 1 and 2 summarize the data completeness for the HGWPAP. The determination of completeness is made by dividing the number of results judged to be valid by the total number of results evaluated and multiplying by 100. Data judged to be valid are results that have not been flagged as suspect, rejected, having a missed holding time, or associated with out-of-limit method blanks or field QC samples. Eighty-seven percent of the 1st quarter's results were considered valid. This percentage is about the same as that for the previous quarter (85%). Roughly 82% of the 1st quarter flags resulted from detection of total organic carbon, total organic halides, anions, metals, and volatile organic compounds in field and method blanks. The majority of these results were at levels near the method detection limits; thus, the overall impact of sample contamination or false-detection on data quality is believed to be minor.

A total of ninety results were flagged with an H this quarter to indicate the recommended holding time had been exceeded. For STL St. Louis, six anion results, seventy-nine results for volatile organic compounds (78 of which were from three samples), and two oil and grease results were flagged. For Lionville Laboratory, three anions results were flagged. Most of the missed holding times were caused by lab error or by the necessity for radiological screening (for analytes with very short holding times).

Table 1. Completeness Summarized by Project

Project	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifers	Results Flagged
100-K Area	224	-	-	-	-	7	7
200 Area P & T	88	-	-	1	-	5	6
216-B-63 Ditch	48	-	-	-	-	10	10
216-U-12 Crib	10	-	-	1	-	1	2
316-5 Trenches	155	-	-	5	26	-	30
400 Area	11	-	-	-	-	2	2
LERF	155	-	-	1	-	10	11
LLWMA-3	666	-	-	41	1	77	102
LLWMA-4	488	3	-	5	-	48	53
Not RCRA/SURV	4874	13	-	44	2	523	555
SALDS	137	-	-	2	-	11	13
Solid Waste Landfill	152	-	-	4	-	16	18
SST WMA-B-BX-BY	667	2	-	4	-	100	105
SST WMA-C	282	-	-	2	-	27	27
SST WMA-S-SX	108	-	-	-	-	24	24
SST WMA-T	139	-	-	1	-	20	20
SST WMA-T3	100	-	-	5	-	11	14
SST WMA-TX-TY	100	-	-	-	-	19	19
SST WMA-U	168	-	-	1	-	28	28
Surveillance Central	3220	13	-	48	2	367	407
Surveillance Horn	1649	11	-	25	6	254	276
Surveillance North	890	1	-	18	1	122	126
Surveillance South	898	-	-	25	52	3	78

Table 2. Completeness Summarized by Method

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifers	Results Flagged
General Chemical Parameters							
120.1_CONDUCT	9	-	-	-	-	-	0
160.1_TDS	1	-	-	-	-	-	0
214A_TURBIDITY	545	-	-	-	-	-	0
310.1_ALKALINITY	215	-	-	-	-	-	0
360.1_OXYGEN_FLD	181	2	-	-	-	-	2
410.4_COD	9	-	-	-	-	3	3
413.1_OILGREASE	8	-	-	-	2	-	2
9020_TOX	194	16	-	4	-	44	63
9040_PH	596	-	-	-	-	-	0
9050_CONDUCT	596	-	-	-	-	-	0
9060_TOC	283	7	-	-	-	167	174
9223_COLIFORM	18	-	-	-	-	-	0
COLOR_TK_SO4_FLD	36	-	-	-	-	-	0
REDOX_PROBE_FLD	125	-	-	-	-	-	0
TEMP_FLD	596	-	-	-	-	-	0
Ammonia and Anions							
300.0_ANIONS_IC	1325	5	-	21	9	198	231
350.1_AMMONIA	15	-	-	-	-	-	0
9012_CYANIDE	58	-	-	4	-	-	4
Metals							
6010_METALS_ICP	4724	12	-	115	-	1217	1234
7060_AS_GFAA	36	-	-	-	-	23	23
7196_CR6	1	-	-	-	-	-	0
7421_PB_GFAA	30	-	-	-	-	1	1
7470_HG_CVAA	30	-	-	-	-	2	2
CR6_HACH_M	29	-	-	-	-	-	0
Volatile Organic Compounds							
8260_VOA_GCMS	2720	-	-	82	79	19	176
WTPH_GASOLINE	8	-	-	-	-	-	0
Semivolatile Organic Compounds							
8040_PHENOLIC_GC	697	-	-	-	-	-	0
8081_PEST_GC	19	-	-	-	-	-	0
8082_PCB_GC	7	-	-	-	-	-	0
8151_HERBICIDE_GC	9	-	-	-	-	-	0
8270_SVOA_GCMS	65	-	-	-	-	-	0
WTPH_DIESEL	8	-	-	-	-	-	0
Radiological Parameters							
906.0_H3_LSC	200	-	-	2	-	-	2
9310_ALPHABETA_GPC	325	1	-	2	-	-	2
BETA_GPC	3	-	-	-	-	-	0
C14_LSC	3	-	-	-	-	-	0
GAMMALL_GS	930	-	-	-	-	-	0
I129LL_ETVDSK_SEP_GS	4	-	-	-	-	-	0
I129LL_SEP_LEPS_GS	65	-	-	-	-	-	0
PUISO_PLATE_AEA	30	-	-	-	-	-	0
RATOT_AEAGEA	3	-	-	-	-	-	0
SE79_SEP_IE_LSC	3	-	-	-	-	-	0
SRISO_SEP_PRECIP_GPC	83	-	-	-	-	-	0

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifers	Results Flagged
TC99_ETVDSK_LSC	185	-	-	3	-	-	3
TC99_SEP_LSC	5	-	-	-	-	-	0
TRITIUM_ELECT_LSC	11	-	-	-	-	-	0
UISO_PLATE_AEA	12	-	-	-	-	-	0
UTOT_KPA	174	-	-	-	-	11	11

Field QC Data

Field QC samples include field duplicates, split samples, and field blanks. Quadruplicate samples collected at many wells for total organic carbon and total organic halides analyses also provide useful QC data. Field blanks collected during the 1st quarter of 2005 included full trip blanks, field transfer blanks and an equipment blank. In general, the desired collection frequency for field duplicates and full trip blanks is one sample per 20 well trips. The target collection frequency for field transfer blanks is one blank on each day in which routine well samples are collected for analysis of volatile organic compounds. Equipment blanks are normally collected once per 10 well trips for portable Grundfos pumps or as needed for special projects. Split samples are also collected on an as-needed basis. Table 3 lists the number of QC samples and their frequencies of collection for the 1st quarter. Results from each type of QC sample are summarized below.

Table 3. Quality Control Samples for 1st Quarter 2005

QC Samples	Number of well trips	Number of QC samples[a]	Frequency
Field Duplicates	319	21	7%
Split Samples	8[b]	8	100%
TOC Quadruplicates	96[c]	58	60%
TOX Quadruplicates	66[c]	39	59%
Full Trip Blanks	319	19	6%
Field Transfer Blanks	VOC samples collected on 20 days	21 (on 19 days)	95%[d]
Equipment Blanks	0[e]	1[f]	--

a values listed do not include field duplicates, split samples, and blanks collected for interim-action groundwater monitoring or nonroutine sampling events (i.e., special projects)

b number of well trips scheduled for split samples

c number of well trips in which TOC and/or TOX samples were collected

d number of days with field transfer blanks divided by the number of days that VOC samples were collected (i.e., 19/20); field transfer blanks were not collected on two days when VOAs were collected, but one field transfer blank was collected on one day when VOC samples were not collected

e number of routine sampling events in which non-dedicated sampling equipment was used

f an equipment blank was collected on a submersible pump by passing reagent water through the sampling manifold

Field duplicates. Field duplicates provide a measure of the overall sampling and analysis precision. Evaluation of field-duplicate data is based on the relative percent difference (RPD) statistic, which is calculated for each matching pair of results. Field duplicates with at least one result greater than 5 times the method detection limit (MDL), instrument detection limit (IDL), or minimum detectable activity (MDA) must have RPDs less than 20% to be considered acceptable. Duplicates with RPDs outside this range are flagged with a Q in the database.

Twenty-one field duplicates were collected and analyzed during the 1st quarter of 2005 to produce 803 pairs of results. Overall, the results demonstrate good sampling and analysis precision. Thirteen pairs of qualifying duplicate results had relative percent differences greater than 20%. Acceptable precision was obtained for two result pairs after reanalyses were performed on samples with out-of-trend results for gross beta. Table 4 lists the remaining eleven pairs of results with poor precision. The high nitrogen in nitrite result from well 299-E24-16 is an obvious outlier based on historical data, but reanalysis would not be useful because of the instability of dissolved nitrite. The cyanide results were probably affected by a malfunctioning heating block that was discovered at STL St. Louis. Low concentrations probably account for the high RPDs for zinc and acetone, because the concentrations were close to the methods' quantitation limits. A reanalysis for iron has been requested for the sample from well 299-E33-16 with the higher concentration; the original result is anomalous compared to historical data.

Table 4. Field Duplicate Results that Exceeded Quality Control Limits

Constituent	Well	Method	Filtered	Result 1		Result 2		RPD
Ammonia and Anions								
Cyanide	299-E33-38	EPA 9012	N	16 µg/L		2 µg/L	U	156%
Cyanide	299-E33-7	EPA 9012	N	2 µg/L	U	21.1 µg/L		165%
Fluoride	199-N-3	EPA 300.0	N	89 µg/L	B	70 µg/L	B	24%
Nitrogen in Nitrite	299-E24-16	EPA 300.0	N	4 µg/L	U	110 µg/L	N	186%
Metals								
Iron	299-E33-16	EPA 6010	Y	689 µg/L		49.6 µg/L	B	173%
Manganese	299-E33-16	EPA 6010	Y	25.5 µg/L		16.2 µg/L		45%
Manganese	299-E33-7	EPA 6010	Y	9.8 µg/L	B	4.4 µg/L	B	76%
Manganese	299-W14-17	EPA 6010	Y	0.99 µg/L	U	10 µg/L	B	164%
Zinc	299-E33-16	EPA 6010	Y	10.7 µg/L	B	8 µg/L	B	29%
Zinc	299-E33-38	EPA 6010	Y	1.5 µg/L	U	12.9 µg/L	B	158%
Volatile Organic Compounds								
Acetone	299-W18-22	EPA 8260	N	0.21 µg/L	U	1.8 µg/L	J	158%

Split Samples. Split samples are replicate samples that are sequentially collected from the same location and analyzed by different laboratories. The results from split samples are useful for confirming out-of-trend results and assessing one laboratory's performance relative to another laboratory. Like field duplicates, split samples should have RPDs less than 20% to be considered acceptable. However, because the two laboratories can have different detection limits, concentrations that are quantifiable at one laboratory may go undetected at the other laboratory. Therefore, the 20% RPD criterion applies only to those results that are quantifiable at both laboratories.

Eight split samples were collected from various wells this quarter to investigate the problem with elevated aluminum results that was reported last quarter. Severn Trent St. Louis and Lionville Laboratory analyzed the samples for metals by EPA method 6010 (inductively coupled plasma - optical emission spectrometry). None of the split sample pairs had results greater than 5 times the detection limits at both laboratories. The results from well 299-W7-4 show a distinct difference between the two labs—STL's result was approximately 3.5 times greater than the result from Lionville Laboratory. In addition, STL detected aluminum in two samples that had corresponding non-detected results from Lionville Laboratory. The remaining samples, however, do not show significant differences between the two laboratories when the detection limits are taken into account (STL's instrument detection limit was 46 µg/L; Lionville Laboratory's limit was 21 µg/L). Based on the low sample concentrations, the results from this split study were inconclusive. Additional split samples may be collected in the future to further investigate the elevated concentrations of aluminum observed at many Hanford wells.

Table 5. Split Results for Aluminum

Well	STL St. Louis		Lionville Laboratory	
199-N-41	45.5 µg/L	U	20.8 µg/L	U
199-N-73	45.5 µg/L	U	54.7 µg/L	C
299-E25-93	47 µg/L	B	20.8 µg/L	U
299-E27-4	45.5 µg/L	U	20.8 µg/L	U
299-W22-44	57 µg/L	B	32.1 µg/L	
299-W22-82	56.3 µg/L	B	20.8 µg/L	U
299-W23-19	45.5 µg/L	U	20.8 µg/L	U
299-W7-4	125 µg/L	BC	35.9 µg/L	C

Total Organic Carbon and Total Organic Halides Quadruplicates. Samples for total organic carbon and total organic halides analyses are normally collected in quadruplicate in accordance with RCRA requirements. While these samples are not intended as QC samples, quadruplicates may provide useful information about the overall sampling and analysis precision for organic indicator parameters. For the purposes of this discussion, total organic carbon and total organic halides quadruplicate data were evaluated based on the relative standard deviation (RSD) for each set of quadruplicate results. Each quadruplicate set having an RSD greater than 20% and at least one result greater than 5 times the method detection limit was considered to have poor precision.

For the 1st quarter, the precision for all qualifying total organic carbon and many total organic halide quadruplicates was acceptable, but 16 out of 39 total organic halide quadruplicates failed to meet the evaluation criteria (Table 6). Low sample concentrations probably account for the poor precision in the total organic halide quadruplicates from wells 199-N-41, 299-E24-33, and 299-W18-23. Six of the quadruplicates in the table contain at least one value marked as suspect (Y flag). Three of the quadruplicates in the table contain at least one value marked as having blank contamination (C flag). Nine of the quadruplicates in the table appeared to contain an outlier (shaded values in the table). In seven cases, removing the outlier either drops the RSDs below the QC limits or produces a set of results that is below quantifiable levels.

Table 6. TOC and TOX Quadruplicates with Low Precision

Well	MDL (µg/L)	Result 1 (µg/L)		Result 2 (µg/L)		Result 3 (µg/L)		Result 4 (µg/L)		RSD
Total Organic Halides										
199-N-3	3.16	18.6	C	5.6		7.9		17.7	C	53%
199-N-41	3.16	4.7	B	8.5		17		6.4		61%
199-N-57	3.16	17.2	C	19.5	C	13	C	8.1	C	35%
199-N-72	3.16	4.7	BC	21.7		15		16.2		49%
199-N-73	3.16	11.4		10.7		29	Y	28	Y	51%
199-N-81	3.16	11		27.2	Y	8.3		21.8	Y	52%
299-E24-33	3.16	10.5		15.8		12		10.3		21%
299-E25-42	3.16	23.2	Y	29.4	Y	25	Y	14.2	Y	28%
299-E25-94	3.16	9.1		10.3		31	Y	12.1		65%
299-W10-21	3.16	33.4		29		16		37.6		32%
299-W15-15	3.16	23.7		21		20		31.7		22%
299-W15-30	3.16	267	D	224	D	502	D	433	D	37%
299-W18-23	3.16	10.1		12.9		7.2		17.8		38%
299-W8-1	3.16	3.2	U	60.8	F	4.4	B	3.2	U	160%
699-25-34B	3.16	5.9	Y	17.7	Y	11	Y	36.8	Y	76%
699-42-42B	3.16	34.7	Y	3.2	U	3.2	U	3.2	U	142%

[a] full trip blank associated with well 299-E27-7

Field Blanks. Full trip blanks, field transfer blanks, and equipment blanks are used to check for contamination resulting from field activities and/or bottle preparation. Definitions of full trip blanks, field transfer blanks, and equipment blanks are provided in the Appendix (p. 23). In general, the QC limit for blank results is 2 times the method detection limit (MDL) or instrument detection limit for chemistry methods and 2 times the total propagated error for radiochemistry methods. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL. Blank results that exceed these limits may indicate a contamination or false-detection problem for regular groundwater samples. Results from groundwater samples that are associated with an out-of-limit field blank are flagged with a Q in the database.

A total of 1,228 results were produced from the 1st quarter field blank samples. Approximately 2% of the results (i.e., 30 results) exceeded the QC limits for field blanks. The percentage of out-of-limit results was roughly the same as the value from last quarter. Table 7 lists the 1st quarter field blank results that were greater than the QC limits. Results that exceeded the QC limits by a factor of 5 or more are shaded in gray. Most of the flagged results were for methylene chloride; however, results were also flagged for nitrogen in nitrate, iron, sodium, zinc, 1,4-dichlorobenzene, acetone, carbon tetrachloride, xylenes (total), strontium-90 and technetium-99. The potential impacts on the data are minor in most cases. For example, although nitrogen in nitrate, sulfate, and sodium had field blank results that were greater than the QC limits, the blank concentrations were significantly lower than the levels of these constituents in most 1st quarter groundwater samples.

Several of the constituents (i.e., nitrogen in nitrate, iron, zinc, acetone, methylene chloride, and xylenes) that had out-of-limit field blank results also had out-of-limit method blank results. Consequently, some of the results in Table 7 may have been caused by laboratory contamination or false-positive detection. Acetone and methylene chloride are common laboratory contaminants that have been detected in previous quarters' method blanks. Low-level detection of these constituents in Hanford groundwater samples should be viewed as tentative.

Table 7. Field Blank Results that Exceeded QC Limits

Constituent Name	Blank Type[(a)]	Result	QC Limit	Result/QC Limit
		Ammonia and Anions		
Nitrogen in nitrate	FTB	8.6 μg/L	7.92 μg/L	1.1
Nitrogen in nitrate	FTB	30 μg/L	7.92 μg/L	3.8
Nitrogen in nitrate	FTB	39 μg/L	7.92 μg/L	4.9
		Metals		
Iron	FTB	20.9 μg/L	13.8 μg/L	1.5
Sodium	FTB	277 μg/L	188.6 μg/L	1.5
Zinc	FTB	4 μg/L	3.0 μg/L	1.3
		Volatile Organic Compounds		
1,4-Dichlorobenzene	FXR	0.26 μg/L	0.18 μg/L	1.4
Acetone	FXR	1.6 μg/L	0.42 μg/L	3.8
Carbon tetrachloride	FXR	0.21 μg/L	0.18 μg/L	1.2
Carbon tetrachloride	FXR	0.41 μg/L	0.18 μg/L	2.3
Methylene chloride	FXR	0.82 μg/L	0.24 μg/L	3.4
Methylene chloride	FXR	0.87 μg/L	0.24 μg/L	3.6
Methylene chloride	FXR	0.92 μg/L	0.24 μg/L	3.8
Methylene chloride	FXR	1.1 μg/L	0.24 μg/L	4.6
Methylene chloride	FXR	1.1 μg/L	0.24 μg/L	4.6
Methylene chloride	FXR	1.3 μg/L	0.24 μg/L	5.4
Methylene chloride	FXR	1.3 μg/L	0.24 μg/L	5.4
Methylene chloride	FXR	1.4 μg/L	0.24 μg/L	5.8
Methylene chloride	FXR	1.6 μg/L	0.24 μg/L	6.7
Methylene chloride	FXR	1.8 μg/L	0.24 μg/L	7.5
Methylene chloride	FXR	1.8 μg/L	0.24 μg/L	7.5
Methylene chloride	FXR	2 μg/L	0.24 μg/L	8.3
Methylene chloride	FXR	2 μg/L	0.24 μg/L	8.3
Methylene chloride	FXR	2.2 μg/L	0.24 μg/L	9.2
Methylene chloride	FXR	2.2 μg/L	0.24 μg/L	9.2
Methylene chloride	FXR	3.1 μg/L	0.24 μg/L	12.9
Xylenes (total)	FTB	0.35 μg/L	0.26 μg/L	1.3
Xylenes (total)	FXR	0.36 μg/L	0.26 μg/L	1.4
		Radiological Parameters		
Strontium-90	EB	1.17 pCi/L	0.6 pCi/L	2.0
Technetium-99	FTB	22.4 pCi/L	16.6 pCi/L	1.3

[a] FTB = Full trip blank, FXR = Field transfer blank, EB = Equipment blank

Laboratory QC Data

Blind Standards. Double-blind standards containing known amounts of selected anions, metals, organic compounds, and radionuclides were prepared and submitted to Severn Trent in February. Duplicates of the total organic carbon and gross beta standards were submitted concurrently to Lionville Laboratory and Eberline Services, respectively. In most cases, the standards were prepared using groundwater from background wells. However, the conductivity standards were prepared commercially in deionized water. A special set of standards for aluminum were also prepared in deionized water. Standards for indicator analyses were spiked using the following constituents: potassium hydrogen phthalate was used to prepare total organic carbon standards, 2,4,5-trichlorophenol was used to prepare TOX-phenol standards, and TOX-VOA standards were prepared using a mixture of carbon tetrachloride, chloroform, and trichloroethene. Gross alpha and gross beta standards were spiked with plutonium-239 and strontium-90, respectively. The standards' spiked concentrations and analytical results are listed in Table 8. Shaded values in the tables were outside the QC limits, as described below.

The acceptance limits for blind standard recoveries are generally 75 – 125% except for radionuclides, which have a ± 30% acceptance range. Most of the results were acceptable, indicating good performance overall. Severn Trent St. Louis had out-of-limit results for total organic carbon, total organic halides, carbon tetrachloride, and aluminum, while Severn Trent Richland had an unacceptable result for plutonium. Lionville Laboratory's results for total organic carbon were also outside the acceptance range. Eberline Services' results for gross beta were acceptable.

All of the total organic carbon results from STL St. Louis and Lionville Laboratory were biased high. The laboratories reanalyzed the samples, but the reanalysis results were similar to the original values. This quarter's samples were spiked at a relatively low concentration (i.e., 1000 µg/L is the practical quantitation limit for both laboratories). Over the past 4 years, the laboratories have had several high-biased results from samples spiked at approximately the same concentration. Collectively, the data demonstrate the method's limited ability to accurately measure organic carbon near the practical quantitation limit.

STL St. Louis' performance on the total organic halides standards was similar to that from last quarter. Most of the results were acceptable, but one of the standards spiked with volatile compounds had a recovery of 49%. Since the other volatile standards had acceptable recoveries, the low result appears to have been caused by a procedural error at the laboratory. An in-house analysis of a replicate sample confirmed that the standards were spiked at the correct concentrations.

The out-of-limit results for carbon tetrachloride and plutonium-239 appear to be isolated instances of poor precision at STL St. Louis and Richland, respectively. Both labs had acceptable results for two out of three of the samples. A reanalysis has been requested for the sample with the low-biased plutonium result.

A special set of blind standards was prepared to help investigate the ongoing problem of elevated aluminum results. The samples were spiked at 100 µg/L (approximately 2 times greater than STL St. Louis' instrument detection limit). Initially, the laboratory's results ranged from 171-186 μg/L (not shown in Table 8). An associated laboratory blank had a detected result of approximately 80 μg/L, suggesting that the instrument had a high background for aluminum. The laboratory reanalyzed the blind standards and obtained lower concentrations (Table 8). However, one of the results remained outside the acceptance range, and all of the results were biased high. One of the standards was also analyzed by ICP-MS to verify that the standards had been spiked at the correct concentrations. The ICP-MS result was 101 μg/L. We have discussed the results with laboratory personnel, but they have been unable to determine the cause of the bias in the ICP results. We are planning to have some certified water and regular groundwater samples analyzed by both ICP and ICP-MS for additional information.

Table 8. Blind Standard Results

Constituent	Spike Amount	Lab[a]	Result 1	Recovery	Result 2	Recovery	Result 3	Recovery	Mean	RSD
General Chemical Parameters										
Conductivity	445uS/cm	SL	421	95%	426	96%	426	96%	424	1%
TOC[b]	1010μg/L	LL	1570	155%	1600	158%	1410	140%	1520	6%
TOC[c]	1010μg/L	SL	1700	168%	1500	149%	1500	149%	1500	11%
TOX (phenol)[d]	900μg/L	SL	1040	116%	1030	114%	923	103%	992	5%
TOX (VOA)	877μg/L	SL	1040	119%	431	49%	722	82%	731	42%
Anions										
Cyanide	199.2μg/L	SL	181	91%	202	101%	191	96%	191	5%
Fluoride	1000μg/L	SL	1200	120%	1200	120%	1200	120%	1200	0%
Nitrate as N	45180μg/L	SL	44800	99%	44700	99%	44300	98%	44600	1%
Metals										
Aluminum	100μg/L	SL	123	123%	123	123%	126	126%	124	1%
Chromium	201.2μg/L	SL	209	104%	206	102%	205	102%	207	1%
Organics										
Carbon tetrachloride	216μg/L	SL	160	74%	180	83%	220	102%	187	16%
Chloroform	498μg/L	SL	510	102%	560	112%	530	106%	533	5%
Trichloroethene	213μg/L	SL	160	75%	170	80%	190	89%	173	9%
Radiological Parameters										
Gross alpha	314.63pCi/L	RL	225	72%	259	82%	268	85%	251	9%
Gross beta[e]	27.58pCi/L	ES	26.5	96%	25.7	93%	29.3	106%	27.2	7%
Gross beta[e]	27.58pCi/L	RL	28.5	103%	29.9	108%	30.8	112%	29.7	4%
Plutonium-239	1.48pCi/L	RL	1.69	114%	1.01	68%	1.56	105%	1.42	25%
Strontium-90	19.6pCi/L	RL	21.2	108%	22.7	116%	20.1	103%	21.3	6%
Technetium-99	1008.4pCi/L	RL	1090	108%	1100	109%	1110	110%	1100	1%
Tritium	258.8pCi/L	RL	240	93%	227	88%	228	88%	232	3%
Uranium-238	149.1μg/L	RL	151	101%	149	100%	156	105%	152	2%

[a] Lab codes: SL = Severn Trent St. Louis, RL = Severn Trent Richland, LL = Lionville Laboratory, ES = Eberline Services

[b] TOC standards were submitted to Lionville Laboratory in quadruplicate. The 4th result was 1500 μg/L, and the recovery was 149%.

[c] TOC standards were submitted to Severn Trent St. Louis in quadruplicate. The 4th TOC result was 1300 μg/L, and the recovery was 129%.

[d] TOX phenol standards were submitted to Severn Trent St. Louis in quadruplicate. The 4th result was 974 μg/L, and the recovery was 108%.

[e] The gross beta spike amount is based on equal contributions from Sr-90 and Y-90 and has been corrected by adding the average gross beta activity of the source-water well (699-49-100C) to the original spiked amount. The average gross beta activity of well 699-49-100C was calculated from quarterly measurements made since the 2nd quarter of last year.

ERA Water Supply/Water Pollution Programs. Severn Trent, St. Louis (STL St. Louis) and Lionville Laboratory participate in the EPA sanctioned Water Supply/Water Pollution (WS/WP) Performance Evaluation studies conducted by Environmental Resources Associates (ERA). Every month, standard water samples are distributed as blind standards to participating laboratories. These samples contain specific organic and inorganic analytes at concentrations unknown to the participating laboratories. After analysis, the laboratories submit their results to the study administrator. Regression equations are used to determine acceptance and warning limits for the study participants. The results of these studies, expressed in this report as a percentage of the results that the PE provider found acceptable, independently verify the level of laboratory performance.

A report from one Water Pollution study (WP-121) was received from STL St. Louis this quarter. The percentage of acceptable results was 95.1%. Values were high for ammonia as nitrogen, orthophosphate as phosphorus, total phosphorus as phosphorus, and acenaphthene. Values were low for total Kjeldahl nitrogen, fluoride, hexavalent chromium, 2-butanone, 4-methyl-2-pentanone, bis(2-chloroisopropyl)ether, grease and oil (gravimetric), copper, and zinc.

Reports from two Water Pollution studies (WP-120 and 121) were received from Lionville Laboratory this quarter. The percentage of acceptable results for WP-120 was 95.1%. WP-121 was a limited make-up study with 4 analytes (calcium, magnesium, fluoride, and chemical oxygen demand) and 100% acceptable results. In WP-120, values were low for total suspended solids, calcium (2 results), magnesium (2 results), total solids at 105C, endosulfan I (2 results), technical chlordane (2 results), bis(2-chloroethyl)ether (2 results), fluoride (2 results), ethylbenzene, tetrachloroethylene, and total xylenes. Values were high for calcium hardness ($CaCO_3$), total hardness ($CaCO_3$), chemical oxygen demand (2 results), total organic carbon (2 results), and acenaphthene. An investigative report discussed the issues of the results for chemical oxygen demand and fluoride. The COD was high because of inadequate agitation during titration. The fluoride was incorrect because the calibration range used was too low.

Mixed Analyte Performance Evaluation Program. The Mixed Analyte Performance Evaluation Program (MAPEP) is conducted by the Department of Energy independent of the Hanford Groundwater Performance Assessment Project. In this program, samples containing metals, volatile and semivolatile organic compounds, and radionuclides are sent to participating laboratories in January and July.

MAPEP results for aqueous samples were available from STL St. Louis, STL Richland, Eberline Services, and Lionville Laboratory this quarter (MAPEP-05-MaW13, GrW13, and OrW13). Four results (iron-55, nickel-63, heptachlor, and 4,4'-DDT) from STL St. Louis were unacceptable; six results (Cesium-134, cesium-137, cobalt-57, cobalt-60, manganese-54, and zinc-65) from STL Richland were unacceptable; one result (nickel-63) from Eberline Services was unacceptable. All other results from the four laboratories were acceptable. Constituents analyzed by STL Richland, STL St. Louis, and Eberline Services included americium-241, cesium-134, cesium-137, cobalt-57, cobalt-60, gross alpha, gross beta, iron-55, manganese-54, nickel-63, plutonium-238, plutonium-239/240, strontium-90, technetium-99, tritium, uranium-234/233, uranium-238, and zinc-65. Constituents analyzed by STL St. Louis and Lionville

Laboratory included antimony (STL St. Louis only), arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium (STL St. Louis only), vanadium, zinc, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol, 1,2,4-trichlorobenzene, naphthalene, hexachlorobutadiene, 2-methylphenol (Lionville only), 2,6-dichlorophenol, 2,6-dinitrotoluene, 2,4-dinitrotoluene, 4-nitrophenol, diethylphthalate, hexachlorobenzene, anthracene, 1,3-dinitrobenzene, pyrene, benzo(a)anthracene, heptachlor (STL St. Louis only), dieldrin (STL St. Louis only), and 4,4'-DDT (STL St. Louis only).

InterLaB RadCheM Proficiency Testing Program Studies. The InterLaB RadCheM Proficiency Testing Program is conducted by Environmental Resource Associates (ERA). Control limits are based on the National Standards for Water Proficiency Testing Studies Criteria Document, December 1998.

No new RadCheM PE results were available this quarter.

Multi-Media Radiochemistry Proficiency Testing Studies. The Multi-Media Radiochemistry Proficiency Testing Program is conducted by Environmental Resource Associates (ERA) and is designed to evaluate the performance of participating laboratories through the analysis of air filter, soil, vegetation, and water samples containing radionuclides. Only the water results are considered in this report. Control limits are based on the guidelines contained in the Department of Energy report EML-564, Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes.

The results from one Mutli-Media Radchem PT study were received from Eberline this quarter (MRAD-002). All results were acceptable. The following were analyzed: americium-241, cesium-134, cesium-137, cobalt-60, gross alpha, gross beta, plutonium-238, plutonium-239, strontium-90, tritium, uranium-234, uranium-238, uranium, and uranium mass.

Laboratory QC Data from Severn Trent Laboratories. Laboratory QC data provide a means of assessing laboratory performance and the suitability of a method for a particular sample matrix. These data are not currently used for in-house validation of individual sample results unless the laboratory is experiencing unusual performance problems with an analytical method. Laboratory QC data include the results from method blanks, laboratory control samples, matrix spikes, matrix spike duplicates, surrogates, and matrix or laboratory duplicates.

Different criteria are used to evaluate the various laboratory QC parameters. Results for method blanks are evaluated based on the frequency of detection above the blank QC limits. In general, these limits are two times the method detection limit (MDL) for chemical constituents and two times the total propagated error (MDA) for radiochemistry components. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is five times the MDL. Results for laboratory control samples, matrix spikes, and surrogates are evaluated by comparing the recovery percentages with minimum and maximum control limits. For matrix duplicates, only those samples with values five times greater than the MDL or MDA are considered. Quantifiable matrix duplicates are evaluated by comparing the relative percent difference (RPD) with an acceptable RPD maximum for each constituent.

As an aid in identifying the most problematic analytes, a distinction has been made between QC data that were slightly out of limits and QC data that were "significantly out-of-limits". For method blanks, "significantly out-of-limits" was defined to mean results were greater than twice the QC limit. For laboratory control samples, matrix spikes, and duplicates, "significantly out-of-limits" means the results were outside the range of the QC limits plus or minus 10 percentage points (e.g., if the QC limits are 80-120%, significantly out-of-limits would mean less than 70% or greater than 130%).

Most of the 1st quarter laboratory QC results were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Table 9 provides a summary of the QC data by listing the percentage of QC results that were out of limits for each analyte category and QC parameter. Table 10 lists the individual constituents that had out-of-limit method blanks, including the concentration range for method blanks above the detection limit. Table 11 summarizes the out-of-limit results for the other QC parameters. The number of significantly out-of-limit results is also indicated in Tables 10 and 11. Finally, Table 12 lists the constituents, analysis dates, and wells having data associated with the significantly out-of-limit QC results. Groundwater sample data associated with blank results that are out of limits could have a contamination or false-detection problem. Groundwater sample data associated with laboratory control samples or matrix spikes that are out of limits should be evaluated for potential biases. It should be noted that these tables incorporate all QC data that were reported for the quarter, including QC results for both original and reanalysis data. However, when samples are reanalyzed, only one set of results (i.e., either the original results or the reanalysis results) are retained in HEIS. Thus, it is possible that some of the QC data described in this report may no longer be associated with current results in HEIS.

Some of the more significant findings from the laboratory QC data are summarized below. Substantial differences between data for last quarter and this quarter are noted for constituent classes; if no comments are made, the data are reasonably similar. To make it easier to compare results between this quarter and the previous quarter, constituents that were cited for the same reason in both quarters are italicized.

- The relative number of out-of-limit results (3.0%) was about the same as that for last quarter (2.1%). This quarter showed an increase in the number of duplicates for general chemistry parameters, matrix spikes for metals, laboratory control samples and duplicates for semivolatile organic compounds, and matrix spikes for radiological parameters that were out of limits. There was a decrease in the number of out-of-limit method blanks for volatile organic compounds and laboratory control samples and duplicates for radiological parameters.

- Two or more method blank results exceeded the QC limits for *chloride*, *fluoride*, nitrogen in nitrate, nitrogen in nitrite, *zinc*, and *methylene chloride*. The percentage of method blank results that were out of limits was lower this quarter for volatile organic compounds.
- Out-of-limit blank results for chloride, nitrogen in nitrate, and sulfate were, in general, not significant because results for most Hanford groundwater samples were significantly higher (at least five times) than the blank values. Many sample results for other constituents with out-of-limit blank results were comparable to the blank values.
- Relative to last quarter, more metals and semivolatile organic compounds, but fewer radiological parameters, had laboratory control samples that were out of limits. Laboratory control samples were significantly out of limits for cyanide, *nitrogen in nitrite*, 2-butanone, methylene chloride, and tetrachloroethene. Table 12 indicates which wells have data associated with laboratory control sample results that were significantly out of limits.
- Compared to last quarter, more metals and more radiological parameters had matrix spike results that were out of limits. *Cyanide*, nitrogen in ammonia, nitrogen in nitrate, *nitrogen in nitrite*, *sulfate*, arsenic, *2-butanone*, *carbon tetrachloride*, chloroform, *methylene chloride*, tetrachloroethene, trichloroethene, TPH diesel, and technetium-99 had matrix spike results that were significantly out of limits.
- Matrix duplicates had more general chemistry parameters and semivolatile organic compounds, but fewer radiological parameters with out-of-limit results compared to last quarter. Matrix duplicates were significantly out of limits for total organic halides, *chloride*, cyanide, fluoride, *nitrogen in nitrate*, *nitrogen in nitrite*, *2-butanone*, *acetone*, carbon tetrachloride, 9 *phenols*, gross alpha, and plutonium-239/240.
- More volatile and semivolatile organic surrogates were out of limits this quarter compared to last quarter. Surrogates were significantly out of limits for *1,2-dichloroethane-d4*, *4-bromofluorobenzene*, dibromofluoromethane, *o-terphenyl*, *toluene-d8*, 2,4,6-tribromophenol, 2-fluorobiphenyl, and nitrobenzene-d5.

Laboratory QC Data from Eberline Services and Lionville Laboratory. First quarter QC data from Lionville Laboratory are limited to total organic carbon and metals. First quarter QC data from Eberline Services are limited to gross beta. All of the QC data for total organic carbon and gross beta were within limits. Several of the metal blanks and duplicates were out of limits. Blanks for calcium (2), iron (2), magnesium (2), sodium (3), and potassium (1) were out of limits in the three samples analyzed this quarter. Duplicates for chromium (1), cobalt (1), copper (3), iron (2), manganese (1), nickel (2), potassium (2), and zinc (2) were also out of limits in the three samples analyzed this quarter. However, the out-of-limit results were not significant because the associated groundwater samples were collected solely for the aluminum investigation.

Project scientists requiring additional information about the laboratory QC data are encouraged to contact Debbie Sklarew or Chris Thompson.

Table 9. Percentage of Out-of-Limit QC Results by Category

	General Chemistry Parameters	Ammonia and Anions	Metals	VOC	SVOC	Radiological Parameters	Total
Method Blanks	0	5.8	1.3	0.7	0	0.4	1.2
Lab Control Samples	0	1.1	0.6	3.4	3.2	0.3	1.8
Matrix Spikes	0	12.7	0.5	6.9	2.3	5.7	4.4
Matrix Duplicates	1.5	2.9	0	1.9	18.5	1.1	3.1
Surrogates	—	—	—	5.3	2.4	—	4.6

Table 10. Method Blanks with Out-of Limit Results

Constituent	Number Out of Limits[a]	Number of Analyses	Concentration Range of Detections
	Ammonia and Anions		
Chloride	4(1)	51	0.088 – 0.18 mg/L
Fluoride	5	51	0.021 – 0.034 mg/L
Nitrogen in nitrate	2(1)	51	0.01 – 0.018 mg/L
Nitrogen in nitrite	4(1)	51	0.011 – 0.019 mg/L
Sulfate	1	51	0.089 mg/L
	Metals		
Iron	1(1)	24	33.3 µg/L
Mercury	1	7	0.18 µg/L
Zinc	4	24	3.3 – 6.0 µg/L
	Volatile Organic Compounds		
Acetone	1(1)	31	2.2 µg/L
Methylene chloride	4	31	0.66 – 1.0 µg/L
Xylenes (total)	1(1)	31	3.2 µg/L
	Radiological Parameters		
Potassium-40	1	24	133 pCi/L
Uranium	1	30	0.0612 µg/L

[a] Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.

Table 11. Laboratory Spikes and Duplicates with Out-of-Limit Results

Constituent	Number Out of Limits[(a)]	Number of Analyses
Laboratory Control Samples		
Ammonia and Anions		
Cyanide	2(1)	10
Nitrogen in nitrite	1(1)	51
Metals		
Aluminum	2	24
Iron	1	24
Volatile Organic Compounds		
1,1,1-Trichloroethane	2	31
1,1-Dichloroethane	1	31
1,4-Dichlorobenzene	1	34
2-Butanone	3(2)	31
Benzene	3	31
Chloroform	1	32
Methylene chloride	3(2)	31
Tetrachloroethene	8(3)	31
Semivolatile Organic Compounds		
2,4-Dichlorophenol	1	16
2,4-Dimethylphenol	2	10
2,6-Dichlorophenol	1	10
2-Methylphenol	1	16
2-secButyl-4,6-dinitrophenol	1	11
4-Chloro-3-methylphenol	1	10
Pentachlorophenol	1	16
Radiological Parameters		
Cesium-137	1	24
Matrix Spikes and Matrix Spike Duplicates		
Ammonia and Anions		
Chloride	1	65
Cyanide	4(4)	15
Nitrogen in ammonia	3(1)	4
Nitrogen in nitrate	4(2)	66
Nitrogen in nitrite	29(24)	66
Sulfate	4(2)	66
Metals		
Arsenic	2(2)	14
Lead	2	14
Sodium	1	54
Volatile Organic Compounds		
1,1,1-Trichloroethane	2	52
1,4-Dichlorobenzene	7	56
2-Butanone	10(8)	54
2-Hexanone	1	4
Benzene	2	52
Carbon tetrachloride	10(9)	58
Chloroform	2(2)	54
cis-1,3-Dichloropropene	1	4
Ethylbenzene	1	50
Methylene chloride	14(2)	52

Constituent	Number Out of Limits[a]	Number of Analyses
Tetrachloroethene	23(9)	52
Trichloroethene	2(2)	54
Semivolatile Organic Compounds		
2-Methylphenol	1	34
bis(2-Ethylhexyl)phthalate	2	12
Endosulfan I	1	2
Endosulfan II	2	2
Oil and grease	4	7
TPH Diesel	2(2)	8
Radiological Parameters		
Technetium-99	4(2)	33
Duplicates		
General Chemistry Parameters		
Total organic halides	2(2)	25
Ammonia and Anions		
Chloride	3(3)	112
Cyanide	2(2)	10
Fluoride	4(4)	113
Nitrogen in nitrate	2(1)	113
Nitrogen in nitrite	5(4)	116
Sulfate	1	113
Volatile Organic Compounds		
2-Butanone	7(5)	40
Acetone	7(2)	39
Carbon tetrachloride	1(1)	44
Semivolatile Organic Compounds		
2,3,4,6-Tetrachlorophenol	1	10
2,4,5-Trichlorophenol	3(1)	10
2,4,6-Trichlorophenol	3(1)	10
2,4-Dichlorophenol	3(1)	16
2,4-Dimethylphenol	3	10
2,4-Dinitrophenol	2	10
2,6-Dichlorophenol	3(1)	10
2-Chlorophenol	3(1)	10
2-Methylphenol	3	16
2-Nitrophenol	3(1)	16
2-secButyl-4,6-dinitrophenol	2	11
3+4 Methylphenol	3	12
4,6-Dinitro-2-methylphenol	2	10
4-Chloro-3-methylphenol	3(1)	10
4-Nitrophenol	2(1)	10
bis(2-Ethylhexyl)phthalate	1	6
Methoxychlor	1	1
Pentachlorophenol	2	16
Phenol	3(2)	17
Radiological Parameters		
Gross alpha	1(1)	22
Plutonium-239/240	1(1)	6
Technetium-99	3	33
Surrogates		
Volatile Organic Compounds		

Constituent	Number Out of Limits[a]	Number of Analyses
1,2-Dichloroethane-d4	11(1)	300
4-Bromofluorobenzene	23(6)	300
Dibromofluoromethane	15(4)	300
o-Terphenyl	9(8)	30
Toluene-d8	8(1)	300
Semivolatile Organic Compounds		
2,4,6-Tribromophenol	3(3)	123
2-Fluorobiphenyl	2(2)	36
2-Fluorophenol	1	123
Nitrobenzene-d5	2(2)	36
Terphenyl-d14	2	36

[a] Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.

Table 12. Wells Associated with Laboratory QC Parameters with Significantly Out-of-Limit Results

Constituent	Analysis Date	Wells with Associated Data
		Method Blanks
Chloride	1/14/05	699-8-17, 699-32-43, 699-41-23, 699-42-42B, 699-43-44, 699-43-45, 699-44-39B, 699-46-21B
Nitrogen in Nitrate	2/5/05	299-E33-4, 299-E33-14, 299-E33-47, 299-E33-48, 299-E33-49, 299-W10-1, 299-W10-28
Nitrogen in Nitrite	1/26/05	299-E25-93, 699-71-77, 699-81-58
Iron	2/1/05	199-K-132, 299-E25-93, 699-71-77, 699-72-92, 699-81-58
Acetone	1/25/05	699-48-77C
Xylenes (total)	2/10/05	699-S31-1
		Laboratory Control Samples
Cyanide	2/14/05	299-E33-14, 299-E33-42, 299-E33-43, 299-E33-44, 299-E33-47, 299-E33-48, 299-E33-49, 699-19-88
Nitrogen in Nitrite	1/8/05	299-E17-14, 299-W18-23
2-Butanone	1/25/05	699-48-77C
	2/10/05	699-S31-1
Methylene chloride	2/11/05	299-W18-22, 399-3-11, 399-3-12, 399-4-11
Tetrachloroethene	2/18/05	699-40-65
	2/28/05	699-23-34B, 699-24-33, 699-24-34B, 699-24-34C
		Matrix Spikes or Matrix Spike Duplicates
Cyanide	2/10/05	299-E33-16, 299-E33-18, 299-E33-26, 299-E33-31, 299-E33-32, 299-E33-34
	4/1/05	699-49-57A, 699-49-57B, 699-53-55C, 699-59-58
Nitrogen in Nitrate	3/7/05	199-N-67, 299-W22-45, 299-W22-80, 299-W22-82, 299-W22-85
Nitrogen in Nitrite	12/28/04	399-3-6, 399-4-9, 399-4-12, 699-12-2C, 699-13-0A, 699-13-1E, 699-13-3A, 699-S19-E13
	12/29/04	199-F5-45, 199-F5-47, 199-F5-48, 399-1-2, 699-13-2D, 699-S3-E12, 699-S27-E14
	1/6/05	299-E25-19, 299-E26-11
	1/7/05	299-E24-16, 299-E26-4, 299-E26-10, 299-W15-15, 299-W18-21
	1/8/05	299-E17-14, 299-W18-23
	1/11/05	399-5-1
	1/12/05	199-K-27, 199-K-29, 699-2-6A, 699-2-7, 699-10-E12, 699-31-31, 699-32-22A
	1/13/05	199-K-109A, 699-10-54A
	1/14/05	699-8-17, 699-32-43, 699-41-23, 699-42-42B, 699-43-44, 699-43-45, 699-44-39B, 699-46-21B
	1/19/05	199-B2-13, 199-B3-1, 199-B4-7, 199-B4-8, 199-B5-1, 699-60-60, 699-61-66
	1/20/05	199-B2-12, 199-B3-1, 199-B4-7, 199-B4-8, 199-B5-1, 699-48-77C, 699-48-77D, 699-60-60, 699-61-62, 699-61-66, 699-63-55, 699-64-62
	1/21/05	699-57-59, 699-71-30
	1/22/05	199-B9-3, 199-B3-47, 699-68-105, 699-72-73, 699-41-1A
	1/26/05	299-E25-93
	1/27/05	199-K-34, 699-72-92

Constituent	Analysis Date	Wells with Associated Data
	1/28/05	199-K-107A, 199-K-111A, 199-K-132, 699-S31-1
	1/29/05	199-B3-46, 199-F5-6, 199-K-32A, 299-E33-34, 299-W18-22, 699-34-41B, 699-S6-E4L,
	2/1/05	199-K-30, 199-K-106A, 299-E28-8, 299-E33-16, 299-E33-18, 299-E33-31, 299-E33-32, 399-3-11, 399-3-12
	2/15/05	699-54-49
	3/1/05	299-E24-33, 299-E25-93, 299-E25-94, 299-E27-4, 299-E27-7, 299-E27-15, 299-E27-21, 299-E27-22, 299-E27-23
	3/10/05	299-W23-19
	3/18/05	199-N-26, 199-N-76, 299-W7-3, 299-W7-5, 299-W7-12, 299-W10-20, 699-96-43
Nitrogen in ammonia	3/8/05	299-W22-83, 299-W23-21
Sulfate	3/11/05	199-N-28, 199-N-34, 199-N-71, 199-N-72
	3/17/05	199-N-18, 299-W10-14, 299-W10-21
Arsenic	3/16/05	299-E24-33, 299-E25-93, 299-E25-94, 299-E27-4, 299-E27-7, 299-E27-15, 299-E27-21, 299-E27-22, 299-E27-23
2-Butanone	1/25/05	699-48-77C
	2/10/05	699-S31-1
	3/4/05	399-1-16A, 399-1-17A, 399-1-17B, 399-1-18A, 399-1-18B
Carbon tetrachloride	1/8/05	299-E26-10, 299-E26-11, 299-W15-15, 299-W18-21
	3/6/05	299-W19-34A, 299-W19-35, 299-W19-36, 299-W19-37, 299-W19-39, 299-W19-40, 299-W19-43, 299-W19-46, 299-W19-48, 299-W21-2, 699-25-34B, 699-38-70B
Methylene chloride	2/22/05	699-26-35C
Tetrachloroethene	2/21/05	699-22-35, 699-23-34A, 699-24-35, 699-25-33A, 699-25-34A, 699-26-33, 699-26-34A, 699-26-34B, 699-26-35A, 699-S6-E4A
TPHDIESEL	3/25/05	199-N-18, 199-N-26
Technetium-99	3/30/05	299-W11-25B
		Duplicates
Total organic halides	4/13/05	299-W7-3, 299-W7-12, 299-W10-20
	4/15/05	299-W7-4
Chloride	1/8/05	299-E17-14, 299-W18-23
	1/11/05	399-5-1
	1/20/05	699-48-77C, 699-48-77D, 699-61-62, 699-63-55, 699-64-62
Cyanide	4/1/05	699-49-57A, 699-49-57B, 699-53-55C, 699-59-58
Fluoride	1/4/05	199-N-75, 199-N-96A
	1/22/05	199-B3-47, 199-B9-3, 699-41-1A, 699-68-105, 699-72-73
	1/26/05	699-71-77, 699-81-58
	2/17/05	299-W14-14, 299-W18-30, 299-W19-47, 699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34B, 699-24-34C, 699-24-35
Nitrogen in Nitrate	3/9/05	199-N-3, 199-N-14, 199-N-21, 199-N-57, 199-N-74
Nitrogen in Nitrite	2/15/05	699-54-49
	2/25/05	299-W19-34A, 299-W19-35, 299-W19-36, 299-W19-37, 299-W19-39, 299-W19-40, 299-W19-43, 299-W19-46, 299-W19-48, 699-38-70B
	3/1/05	299-E24-33, 299-E25-93, 299-E25-94, 299-E27-4, 299-E27-7, 299-E27-15, 299-E27-21, 299-E27-22, 299-E27-23
	3/9/05	199-N-3, 199-N-14, 199-N-21, 199-N-57, 199-N-74

Constituent	Analysis Date	Wells with Associated Data
2-Butanone	1/25/05	699-48-77C
	2/13/05	699-49-100C
Acetone	2/11/05	399-4-11
	2/22/05	699-26-35C
2,4,5-Trichlorophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
2,4,6-Trichlorophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
2,4-Dichlorophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
2,6-Dichlorophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
2-Chlorophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
2-Nitrophenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
4-Chloro-3-methylphenol	3/30/05	299-W7-3, 299-W7-4, 299-W7-5, 299-W7-12, 299-W8-1, 299-W10-14, 299-W10-20, 299-W10-21
4-Nitrophenol	3/22/05	299-W22-83, 299-W23-21
Phenol	2/23/05	299-W18-22
	3/22/05	299-W22-83, 299-W23-21
Gross alpha	4/19/05	699-S6-E4A
	Surrogates	
4-Bromofluorobenzene	2/12/05	399-3-11, 399-3-12
	2/13/05	699-49-100C
	4/1/05	299-W7-4, 299-W8-1, 399-1-17B
Dibromofluoromethane	3/29/05	299-W7-3, 299-W7-5, 299-W7-12, 299-W10-20, 299-W10-21, 399-1-16A, 399-1-16B, 399-1-17A, 399-1-18A, 399-1-18B
o-Terphenyl	2/25/05	699-S6-E4A
	3/24/05	199-N-3, 199-N-19, 199-N-21, 199-N-56, 199-N-96A, 299-W22-83, 299-W23-21
	3/25/05	199-N-18, 199-N-26
	3/28/05	199-N-18, 199-N-26
2,4,6-Tribromophenol	2/23/05	299-W18-22

Appendix: Field Blank Definitions

Full Trip Blank (FTB) – A field blank sample that is used to check for sample contamination resulting from sample bottles, preservatives, and sample storage and handling. FTBs are initially prepared in the laboratory by filling a preserved bottle set with Type II reagent water. After the bottles have been sealed, they are transported to the field in the same storage container that will be used for groundwater samples collected that day. FTBs are not removed from the storage container until they have been delivered to the laboratory. Normally, FTBs are analyzed for the same constituents as the samples from an associated well.

Field Transfer Blank (FXR) – A field blank sample that is used to check for in-the-field sample contamination by volatile organic compounds. FXRs are prepared near a well sampling site by filling preserved VOA sample bottles with Type II reagent water that has been transported to the field. FXRs are normally prepared at the same time VOA samples are being collected from the well. After collection, the FXR bottles are sealed and placed in the same sample storage container as the rest of the samples. FXRs are not removed from the storage container until they have been delivered to the lab.

Equipment Blank (EB) – A field blank sample that is used to check for sample contamination caused by unclean sampling equipment or the sampling equipment itself. Generally, equipment blanks are only collected at wells that are sampled using non-dedicated pumps. EBs are prepared by passing Type II reagent water through the pump or manifold after the equipment has been decontaminated (sometimes just prior to sampling a well) and collecting the rinsate in preserved bottles. EBs are placed in the same container as other field samples and are not removed from the container until they have been delivered to the lab. Typically, EBs are analyzed for the same constituents as the samples from the associated well.